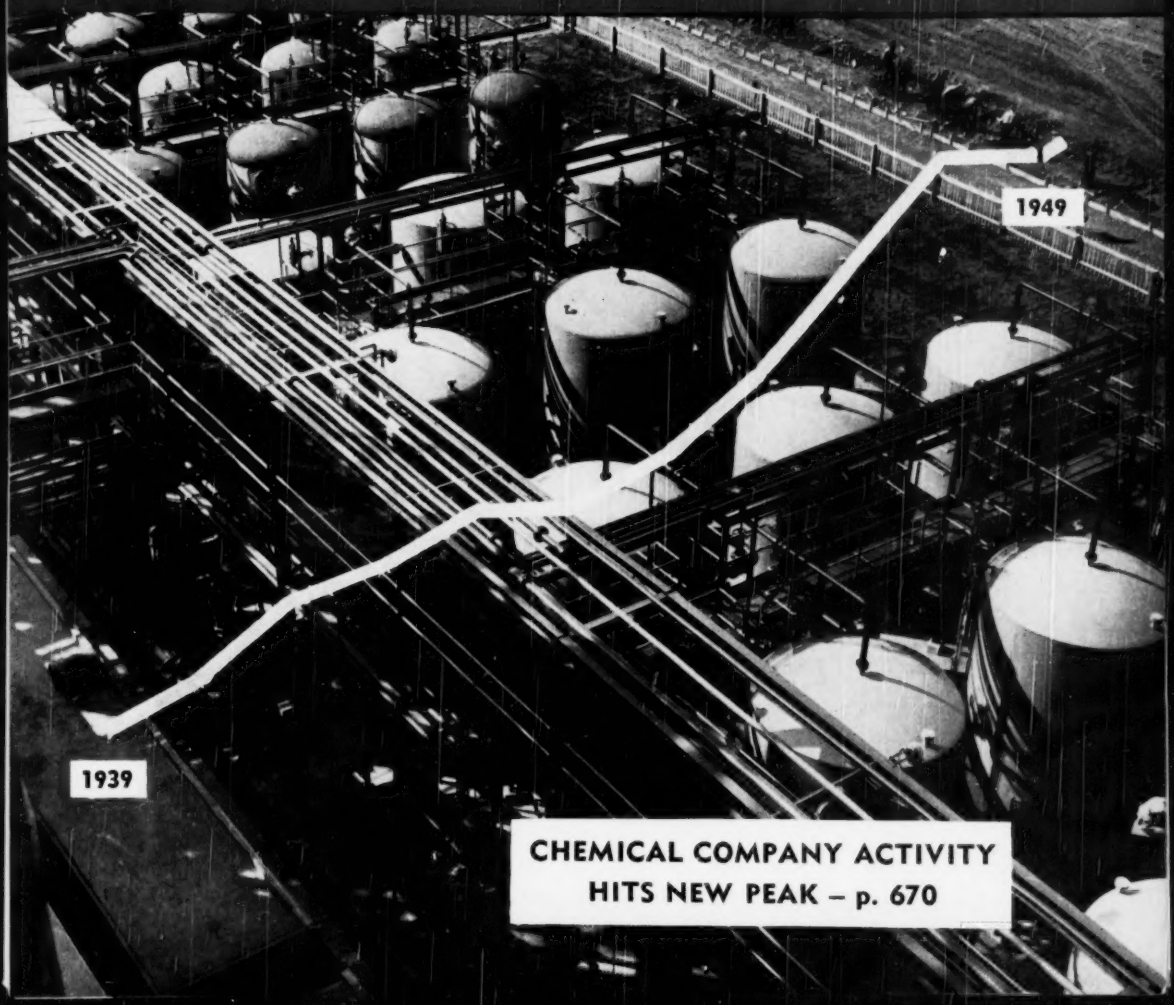
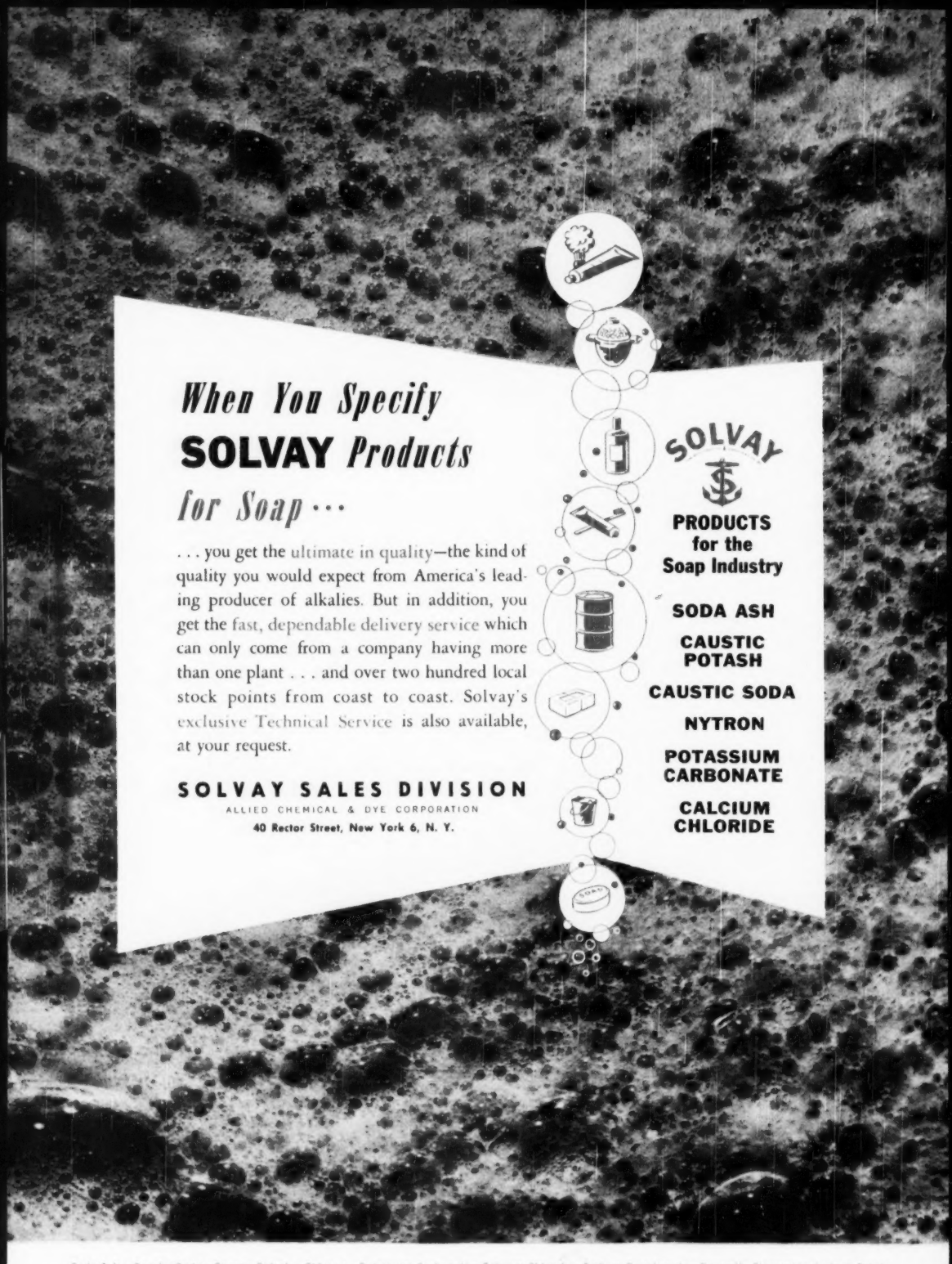
Chemical Industries

Including CHEMICAL SPECIALTIES

MAY 1950



CHEMICAL COMPANY ACTIVITY HITS NEW PEAK – p. 670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. . . you get the ultimate in quality—the kind of quality you would expect from America's leading producer of alkalies. But in addition, you get the fast, dependable delivery service which can only come from a company having more than one plant . . . and over two hundred local stock points from coast to coast. Solvay's exclusive Technical Service is also available, at your request.
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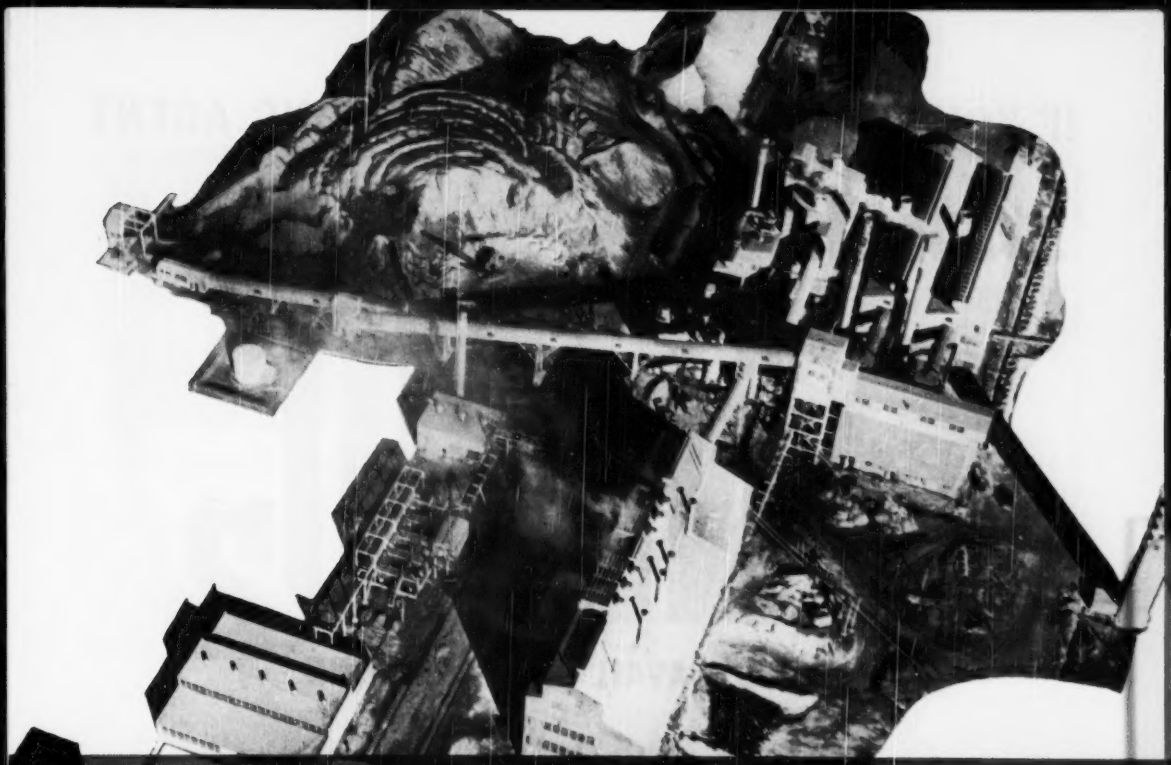


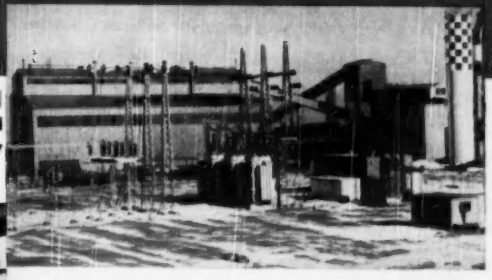
Progress Report on Westvaco CHEMICALS PHOSPHATES

With our second furnace at Pocatello, Idaho now well past the "shake-down stage", this new elemental Phosphorus plant is exceeding anticipated output both as to quality and quantity.

Additions to and improvements in our plant at Carteret, New Jersey have been completed, as have also our new phosphate facilities at Newark, California.

While substantially all of our immediate production has been contracted, we will welcome an opportunity to discuss your requirements, if you can be most economically served on phosphates from Carteret, N. J., or Newark, Calif.; on Caustic Soda or Caustic Potash from South Charleston, W. Va.; on Natural Soda Ash from Westvaco, Wyoming.

CAUSTIC POTASH—Liquid 45-50%, Flake and Solid 88-92% • CAUSTIC SODA—Liquid 50% Standard and Bayou Grades; Liquid 70-73% Standard Grade, Flake and Solid • NATURAL SODA ASH • ACID SODIUM PYRO-PHOSPHATE • DISODIUM PHOSPHATE • MONOSODIUM PHOSPHATE • SODIUM TRIPOLYPHOSPHATE • TETRAPOTASSIUM PYROPHOSPHATE • TETRASODIUM PYROPHOSPHATE • TETRASODIUM PYROPHOSPHATE CRYSTALS • MONOPOTASSIUM PHOSPHATE • DIPOTASSIUM PHOSPHATE • TRIPOTASSIUM PHOSPHATE • PHOSPHORIC ACID 75%



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Chemical Industries

Including CHEMICAL SPECIALTIES

Vol. 66, No. 5

MAY 1950

THE MAGAZINE OF THE CHEMICAL PROCESS INDUSTRIES

What's new

FEATURES

CHEMICAL SPECIALTIES

EVERY MONTH

The Advertisers Index will be found on page 793

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ABP ABC

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THE READER WRITES

It is Easier to "Pass the Buck"

To the Editor of Chemical Industries:

A month or so ago the writer wrote an airmail letter to a prominent concern in a distant city in which a definite question was asked. It was a question that could be answered by mail, and the question was sufficiently complete so that an answer could be given by return airmail. The fact that the letter was sent by airmail should have indicated to the concern that a prompt reply was desired.

Did the concern write an immediate reply? No. They first sent the letter to an office in another city in the same state, and then that office wrote as follows: "We are pleased to advise you that our distributor in your territory is Mr. ———, at ———. We are sending a copy of this correspondence to Mr. ———, and he will be glad to give you further information."

After a wait of about two weeks the above Mr. ——— did not appear, whereupon the writer wrote another airmail letter to the first address, repeating the first letter, and requesting a prompt reply. It was made clear that personal appearance of the representative was not necessary and that the writer felt that a more satisfactory reply could be given by the home office anyway. The question pertained to equipment manufactured by the concern questioned so the manufacturer himself should surely know enough about his own product to be able to answer the question.

In another week the reply was received, and it was a satisfactory reply, but by that time the questioner had just about lost his pleasant disposition. There was too much delay and too much "passing the buck." It is a common failing which manufacturers as well as others should strive to correct.

W. F. Schaphorst
Newark, New Jersey

Production Costs on Caustic Soda in Japan

To the Editor of Chemical Industries:

We were very much interested in the article, "What's Ahead for the Alkali-Chlorine Market," p. 936, in your June 1949 issue.

With reference to it, we would like to know the estimated manufacturing costs of electrolytic caustic soda, in comparison with lime-soda, in America.

Now that we are operating electrolytic caustic soda plants, we wish to mention for your guidance that the following are the current manufacturing cost estimates of electrolytic caustic in Japan:

	% of total cost
Salt	16.14%
Electricity	10.69
Coal	19.57
Other Materials	8.84
Sub-Total	55.24
Labor Expense	6.13
Repairing Expense	2.50
Other Expenses	36.14
	100.00%

Total manufacturing cost about $96 per ton.

Keiichiro Ishii
Nippon Soda Company, Ltd.
Tokyo, Japan

Howard Book Brings Memories

To the Editor of Chemical Industries:

I recently had the pleasure of reading *Charting My Life* by Henry Howard, who was for many years vice president of the old Merrimac Chemical Co. It was most interesting to me, as I joined the Merrimac chemical staff a couple of years before Mr. Howard left there. I still have vivid recollections of those days. Howard was an extremely active and a highly positive individual, as is evident from his accomplishments in so many fields.

I had plenty of chance to struggle with some of his inventions, especially the lute valve in the bisulfite plant, which was an enormous lead affair operated by raising the lute about ten feet on a windlass, turning a quarter of a turn and then lowering the lead pipes into place again. Its purpose was to change the flow of sulfur dioxide through a series of absorbers whenever the final absorber in the series was finished. On many a night I have hunted up a lead burner and gone to the plant, dug out the blueprints and spent the night finding what was wrong with the lute and repairing the lead.

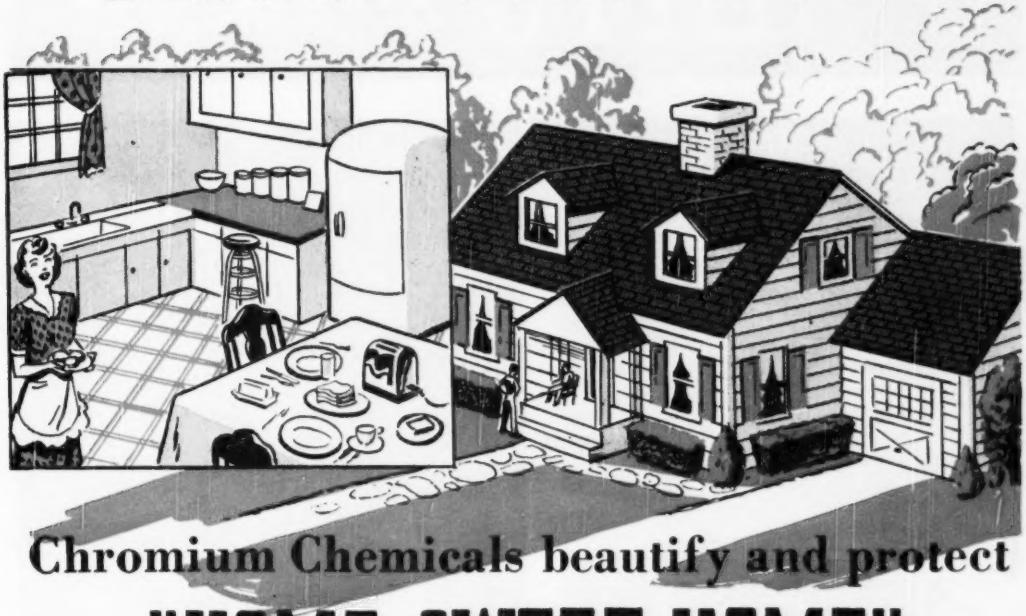
In my younger days I was sometimes a little scornful of some of the Howard inventions, as new and better ways of doing things were coming along fast at that time. Looking back with more mature judgment, I am now full of respect for the ingenuity Howard showed in meeting problems with the relatively limited materials available at that time.

D. S. Dinsmoor
American Potash & Chemical Corp.
Los Angeles, Calif.

Correction

On page 524 of the CI Report on Newer Synthetic Fibers last month, the tensile strength of nylon was incorrectly given as 7-15,000 psi. The correct figure is closer to 50,000 psi.

Inside and Out...



Chromium Chemicals beautify and protect

"HOME SWEET HOME"

Start at the roof which is probably covered by granules of light-fast, fire-proof Chrome Oxide Green. Then notice the doors, screens and shutters. Chances are these are beautified and protected with Chrome Green paint. Even the lumber which forms the structure itself may have been treated with Chromate to prevent its destruction by rot and termites.

Among the first items to meet the eye upon entering the house are wall paper, floor coverings, draperies and upholstery. All of these, including Dad's leather-covered easy chair, are made by processes involving the use of Chromium Chemicals. Then visit the kitchen and bathroom noting how bright, tarnish-proof Chromium Plating enhances the beauty and protects the metal surfaces of plumbing fixtures and electrical appliances.

Mutual's two complete plants supplemented by dealer's warehouse stocks, are geared to serve those industries making supplies for the home builder. The quality of Mutual products and the standard of service rendered in their sale and distribution were never higher than they are today.

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CHROMIUM CHEMICALS

Life ...on the

Photo courtesy S. Blickman, Inc.

SEWING QUALITIES are receiving greater attention in modern textile finishing operations. A number of Cyanamid's finishing oils and soluble waxes are designed to give improved sewing qualities to fabrics as well as softness, suppleness and good hand, thus combining workability and sales appeal, together with wearability.

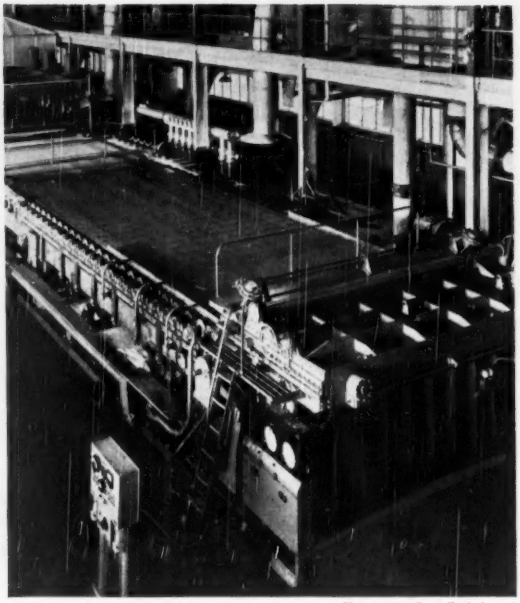
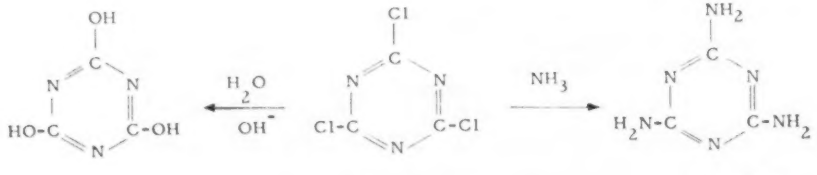


Photo courtesy Paper Trade Journal

WORK-HORSE OF THE PAPER INDUSTRY the famous Fourdrinier paper-making machine transforms wet wood pulp into finished paper. Cyanamid's gum, wood, and ACCOBRITE* Rosin Sizes impart ink resistance to paper, adapting it to writing and printing; and they improve its water resistance. Cyanamid's complete line of paper chemicals makes it a recognized source of supply for the paper industry.



Cyanuric acid — Cyanuric chloride — Melamine

CHEMICAL FORMULA FOR CYANURIC CHLORIDE (center) shows its close relationship to cyanuric acid and melamine. This highly reactive intermediate has been suggested for use in the synthesis of pharmaceuticals, explosives, rubber chemicals, surface-active agents, and in textile and fluorescent dyes for laundry soaps. Other potential uses are under investigation by Cyanamid's New Product Development Department, and pilot-plant quantities are available. For full information on chemical and physical properties, send in the coupon.

Chemical Newsfront

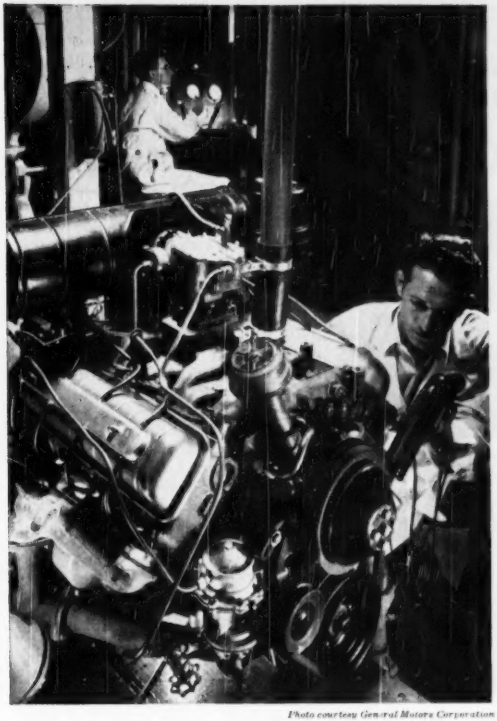


Photo courtesy General Motors Corporation

TO MEET THE NEEDS OF MODERN high-compression engines, Cyanamid has developed the efficient AEROCAT® Synthetic Fluid Catalysts for use in the production of top-grade gasolines. In modern fluid cracking techniques, these catalysts, including the MS or "Microspheroidal" form which represents the latest advancement in this field, today make possible refining operations that were unthinkable a few years ago. Working in cooperation with the petroleum industry for many years, Cyanamid has developed a number of important petroleum chemicals such as AEROLUBE® Additives for regular, premium and heavy-duty motor oils, AERO* Stearates for grease-making, Gasoline Dyes and Drilling Mud Chemicals.

*Trade-mark

Photo courtesy The Borden Company

SPEED UP OF BOTTLE-WASHING in bottling plants is now being effected with AEROSOL® Wetting Agents used in conjunction with the usual caustic soda wash. Because of their remarkable ability to lower surface and interfacial tension, AEROSOL Wetting Agents accelerate countless industrial processes.

American Cyanamid Company
Industrial Chemicals Division
30 Rockefeller Plaza, New York 20, N. Y.

Please send literature or further data on the products checked:

- ☐ AEROSOL Wetting Agents
- ☐ AERO Stearates for grease-making
- ☐ AEROCAT Synthetic Fluid Catalysts
- ☐ CYANURIC Chloride
- ☐ AEROLUBE Additives
- ☐ NO-ODOROL® Finishing Oils, and Soluble Waxes
- ☐ Rosin Sizes for Paper

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For Your Information

Every month Monsanto publishes these pages of pertinent information, selected to help you improve your products, lower your production costs, increase your sales.

NEW, granular SANTOMERSE No. 1 developed especially to blend

Blenders of cleaning compounds who want to turn out a granular product, and who want various ingredients to lose their identity in the finished compound, will find the new Santomerse * No. 1, granular, tailored to their needs. In fact, the new granular Santomerse No. 1 was produced especially for such applications.

Santomerse No. 1, granular, mixes perfectly with phosphates, silicates and carbonates, making a thorough mechanical blend that has less tendency to stratify.

NEW Santomerse No. 1 granules.

Chemically, Santomerse No. 1, granular, is identical with Santomerse No. 1 flakes. It is a rapid wetter and an effective, all-purpose detergent that lifts out dirt and grease and holds particles in suspension so they are whisked away in the rinse. Santomerse No. 1 rinses easily . . . thoroughly. It is effective in hot or cold, hard or soft water and in acid or alkaline solutions. For further information mail the coupon or contact the nearest Monsanto Sales Office.

Research Chemists' Corner

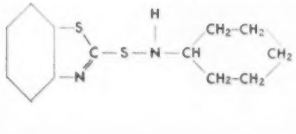
You may find something new here

The future of N-cyclohexyl-2-benzothiazole sulfenamide still is to be revealed by scientists who like to venture into chemical research projects. Listed below are properties of this Monsanto Chemical. Look them over and see if you find possibilities for developing something new to serve mankind. Then, if you want to look into the future of the chemical through the medium of research . . . mail the coupon for a sample to use in your experiments. Samples will be sent free and without obligating you in any way.

N-CYCLOHEXYL-2-BENZOTHIAZOLE SULFENAMIDE

Appearance:	Light tan or buff powder
Fineness:	100% through 30-mesh
Melting Point:	94° C. minimum
Specific Gravity:	1.27 @ 25° C.
Moisture:	1.0% maximum after drying 24 hours at 50° C.
Ash:	0.5% maximum
Solubility:	Very soluble in benzene, chloroform, chlorobenzene and butyl alcohol

Structure:



Reactions: Reacts with carbon disulfide to produce mercaptobenzothiazole, cyclohexyl isothiocyanate and sulfur.

Reacts with glacial acetic acid producing 2,2'-dithio-bis-benzothiazole.

Combines with metal salts in anhydrous medium forming addition compounds.

Paints and plastics gain in quality with low-cost AROCLORS

Monsanto AROCLORS (chlorinated biphenyl and chlorinated polyphenyls) put extra qualities in many paints and plastics while actually reducing production costs. Lowered production costs are possible because of the favorable price of the ARO-CLOR. *

In the protective coating industry, the AROCLORS are used in modified and synthetic rubber coatings, lacquers, hot-melt strip coatings, vinyl protective coatings, maintenance paints, adhesives, fire-resistant paints and marine paints.

With the AROCLORS, paints gain toughness, gloss, non-flammability, good adhesion and high resistance to water, acids, alkali and other corrosive influences.

In the plastics field, various AROCLORS are used as co-plasticizers or as extenders for more expensive plasticizers. They serve as co-plasticizers with tricresyl phosphate, dioctyl phthalate and other plasticizers in polyvinyl chloride. The AROCLORS perform similar service or act as extenders to more expensive plasticizers in nitrocellulose, ethyl cellulose, cellulose acetate-butyrate, polystyrene and certain rubber polymers.

There is a series of AROCLORS . . . both in liquids and resins . . . giving manufacturers a wide selection from which to choose exactly the properties they want for their production. For further information and quotations on the AROCLORS, mail the coupon or contact the nearest Monsanto Sales Office. If you have a question on the application of the AROCLORS to a specific product, write the Phosphate Division, Monsanto Chemical Company, St. Louis 4, Missouri.

Dusting and sudsing are controlled by Sterox CD

Both dust and suds are kept under control when Monsanto Sterox * CD is added to detergent compounds. In addition, Sterox CD gives these blends better appearance, makes them easier to handle, increases their detergency.

Non-ionic Sterox CD is compatible with soap, carbonates, silicates, phosphates and all synthetic detergents. Sterox CD can be used to build compounds that give satisfactory operation in cleaning processes where agitation is necessary and where excessive foam is objectionable.

WITH SANTOCHLOR suspended in a small bag at the top of the jar, mildew was completely inactive.

WITHOUT SANTOCHLOR, the same articles in a side-by-side test underwent heavy mildew attack.

MILDEW IS STOPPED BY SANTOCHLOR in closed tropicalization chamber test

Santochlor,* Monsanto's para-dichlorobenzene, widely used mothicide, larvacide and deodorant, has proved its ability to control mildew in a 3½-month closed tropicalization chamber test. The test was conducted in Monsanto's laboratories in St. Louis.

In the laboratory test, a pair of shoes was divided, one going into a closed jar with Santochlor and the other in a like jar without "para." Each jar also contained a book and pieces of wool and cotton cloth. Conditions of heat and humidity were kept exactly alike in both containers. To prevent stagnation, jars were left uncovered ½ hour twice weekly.

After the 3½-month incubation period, it was found that the articles in the jar with Santochlor were absolutely free of any trace of mildew. Twin articles in the other container were severely damaged by mildew.

This ability of Santochlor to inhibit mildew development has been proved in home storage. As in moth-preventive usage, a substantially saturated atmosphere must be maintained continuously around the stored items.

If you have a mildew problem in connection with stored materials, this test indicates that Santochlor may be your solution. For full details about the application of Santochlor to prevent mildew, mail the coupon or contact the nearest Monsanto Sales Office.

BAI accepts SANTICIZER 141
as plasticizer for food wrappings

Based on results of feeding and extraction tests extending over two years, the Bureau of Animal Industry of the United States Department of Agriculture has accepted Santicizer* 141 as a plasticizer for synthetic plastic films used to package food products. This is *positive proof of the nontoxicity* of Monsanto Santicizer 141 . . . proof that Santicizer 141 is the plasticizer to use in *any application* where nontoxicity is required.

Polyvinyl chloride film, plasticized with Santicizer 141, offers many distinct qualities of value to food packaging. It is tougher than most other films, hence less likely to tear. It provides excellent protection because it heat-seals easily and securely. With Santicizer 141, it is possible to make film that is easy to print and process . . . that has excellent low-temperature flexibility.

Complete information is available to you upon request. Indicate your wishes on the coupon.

Fire-resistant hydraulic fluid proves its value in coal mines

Monsanto's flame-resistant hydraulic fluid, OS-16, came through with flying colors after a severe test in service in a coal-cutting machine.

The coal cutter in which OS-16 was used operated 24 hours a day, three days a week, for approximately three months. At the end of that time the machine was removed from the mine, taken apart and thoroughly inspected.

Hydraulic pumps and other moving parts in contact with OS-16 were in perfect condition, showing no signs of wear whatever.

OS-16, one of the hydraulic fluids made by Monsanto, has possibilities for other industries, particularly where flame resistance and lubrication are needed along with power transmission.

If hydraulic fluids have a part in the operation of your plant, it will be worth your while to investigate Monsanto OS-16. Mail the coupon for further information.

*Reg. U. S. Pat. Off.

MONSANTO CHEMICAL COMPANY, 1703-E South Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

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INFORMATION

..... Santochlor (para-Dichlorobenzene)
..... Santicizer 141
..... Hydraulic Fluid OS-16
..... Sterox CD
..... Santomerse No. 1
..... Aroclors

SAMPLE

..... N-Cyclohexyl-2-Benzothiazole Sulfenamide

MONSANTO CHEMICAL COMPANY
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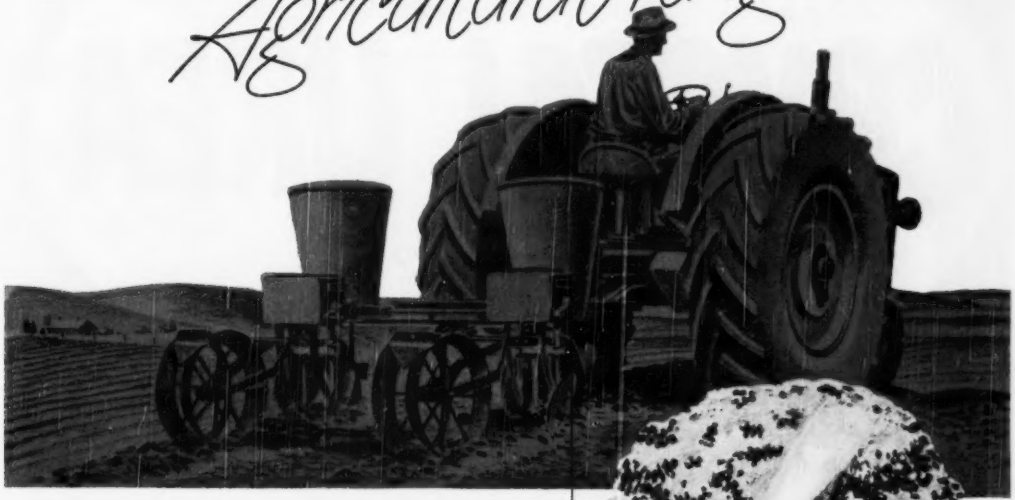
*Reg. U. S. Pat. Off.

Pittsburgh Agricultural Fungicides



Pittsburgh Spergon-sl*

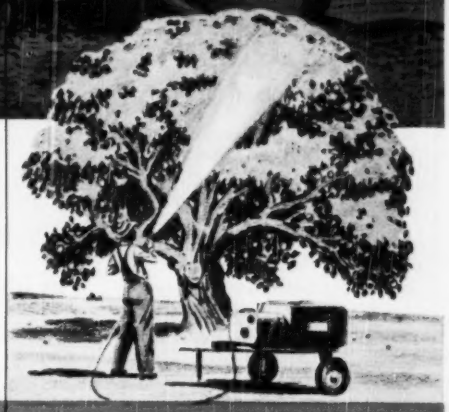
A safer, better seed protectant

Pittsburgh Spergon-sl is a non-metallic organic chemical fungicide . . . a highly effective protectant against the harmful fungi that cause seed decay and "damping off" of plants in the early post-emergence stage. Spergon-treatment of seeds, prior to planting, largely prevents seed and crop losses, as well as delays caused by necessity for reseeding.

Best of all, it is a really *safe* protectant to use . . . *safe* for humans, for animals, and for the seed itself. It is non-irritating to flesh or to the sensitive mucous membrane of the operator. And even an over-application of it cannot harm most valuable seed. More, this dry wettable powder can be used in either the slurry method or as a dry seed treatment and will not cause sticking or clogging in seed drills. It can be safely applied, too, with legume inoculation bacteria, if used according to directions. For corn, peas, beans, alfalfa and many other seeds, *Pittsburgh* Spergon-sl is the "perfect" protectant.

Write for a bulletin giving full technical information.

* Registered trade name for tetra-chloro-para-benzoquinone



Pittsburgh Phygon-xl* . . .

a new improved fungicidal spray

Pittsburgh Phygon-xl is a highly effective spray for the control of many of the fungous diseases of fruit trees, ornamental shrubs, and vegetables. It may be utilized, also, as a seed protectant.

It is easy to use, may be added directly to the water in the spray tank and is compatible with lead arsenate, DDT, Rotenone and Chlordane.

Ask for a bulletin giving full information about application.

* Registered trade name for 2, 3-dichloro-1, 4-naphthoquinone

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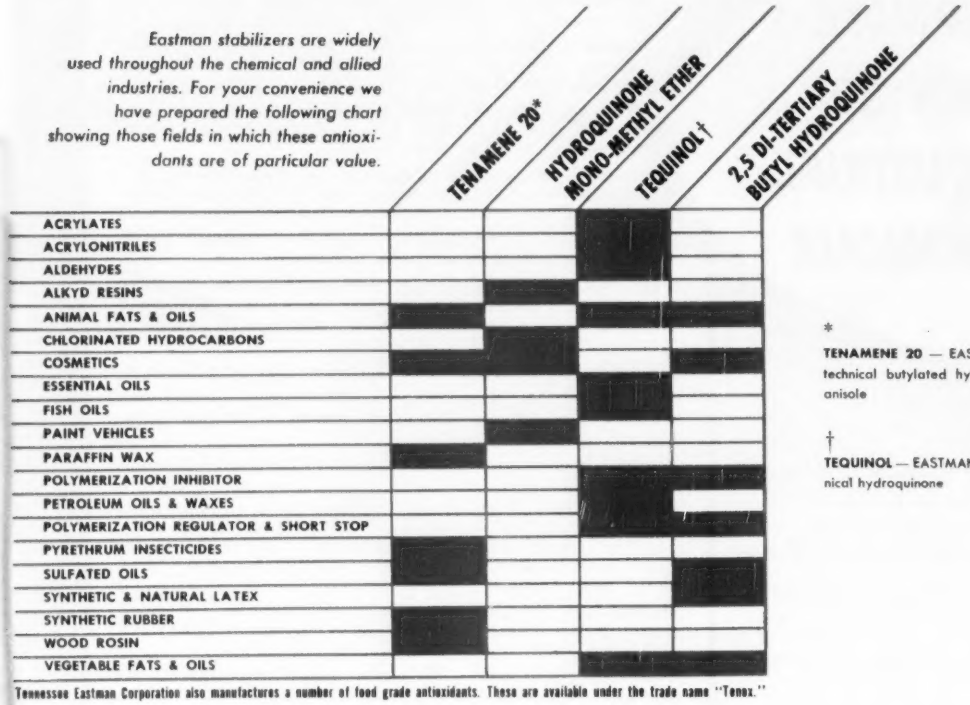

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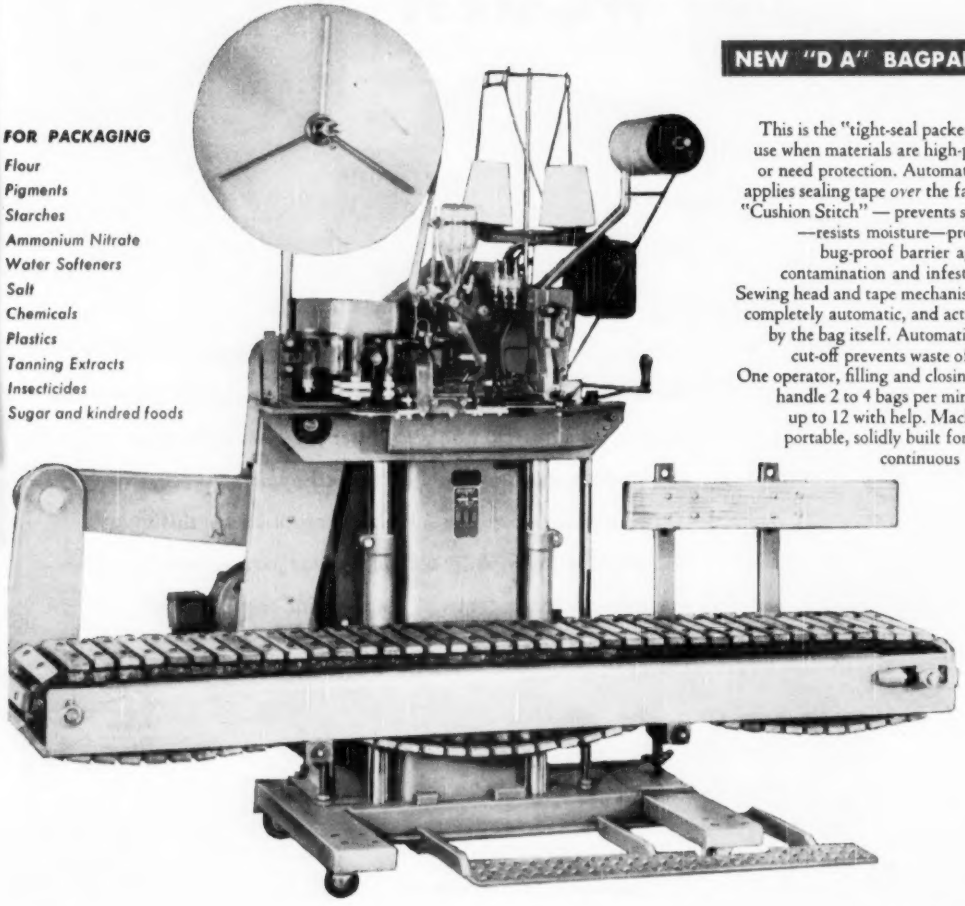

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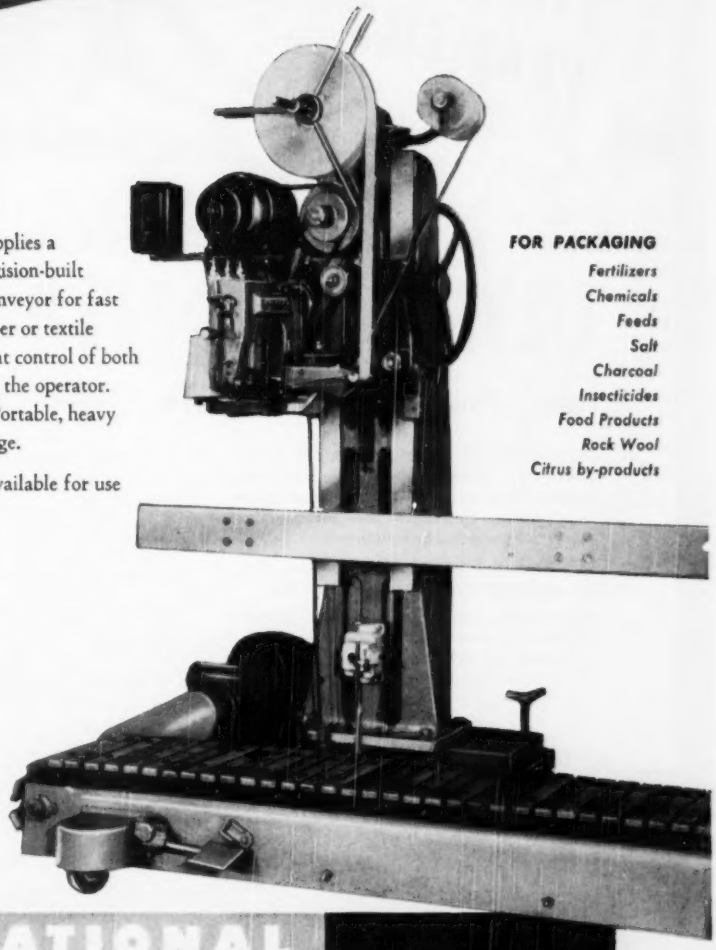

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- Freezing Point
- Heat of Adsorption
- Heat Capacity
- Heat of Combustion
- Heat of Formation
- Heat of Fusion
- Heat of Vaporization
- Solubility
- Surface Tension
- Toxicity
- Vapor Pressure
- Viscosity

II. Aqueous Solutions of Methylamines

- Containers
- Density
- Distribution Coefficients (Water and Organic Solvents)
- Flash Points
- Freezing Points
- Heat of Neutralization
- Heat of Solution
- Ionization Constants
- pH vs. Concentration
- Solubility in Water
- Surface Tension
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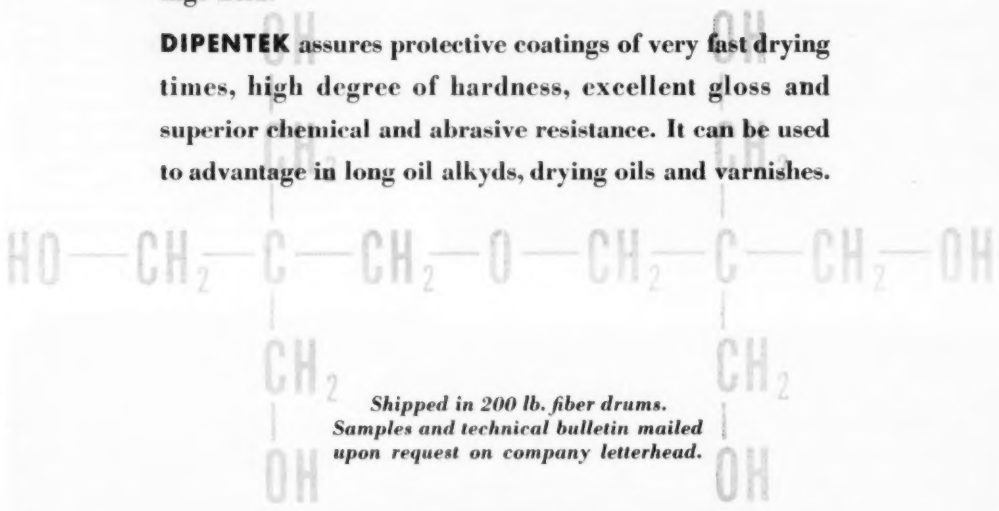

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Chemical Industries

THE MAGAZINE OF THE CHEMICAL PROCESS INDUSTRIES

Newsletter,
May, 1950

Dow Chemical of Canada, Ltd., is breaking ground for a new plant at Sarnia, Ont. Production is expected before year's end. Principal products will be carbon tetrachloride, perchloroethylene, and trichloroethylene (and hydrochloric acid will be an important by-product). Existing units at Sarnia will provide the major raw materials.

Tertiary-butyl benzoic acid of 99% purity is now available in drum quantities from Shell Development Co., Emeryville, Cal. Major expected use: in alkyds, where it appears to give improved hardness and color retention on exposure to heat and light. Its price--33¢ a lb.--is lower than that of benzoic acid, also used for the same general purpose.

* * CI * *

Although polyethylene sheeting is not a complete replacement for vinyl sheeting, it is versatile enough so that plasticizer makers are concerned about the long-range prospect. Polyethylene requires no plasticizer. So far, polyethylene's unique applications--in frozen food packaging, for instance, where vinyls can't be used--have obscured its threat to established sheeting materials.

Use of styrene-butadiene latex has been characterized by an official of a large paint firm as the third revolution in the paint field within a generation (first: titanium pigments; second: synthetic resins). Dow's explosion and fire in February (CI, March 1950, p. 437) has delayed introduction of some new latex-base water-mixed paints, but several rubber companies are busy developing latex techniques, soon hope to have materials to help supply this booming market.

* * CI * *

Godfrey L. Cabot, Inc., Boston, is producing pilot-plant quantities of a new finely divided alumina, called Alon. More finely divided than any other commercial alumina and considerably finer than most other pigments, it is expected to find use in rubber (reinforcing agent), neoprene and butyl (for heat resistance), paints and inks (dispersing aid, color extender, viscosity control agent). Other promising fields: catalysts, ceramics, latex, plastics. Full-scale plant hinges on outcome of market development.

Metal Hydrides, Inc., Beverly, Mass., will soon be announcing availability of two new products--borohydrides of sodium and lithium--in limited quantities. The former, since it reacts only slightly with cold

water (in which it is moderately soluble), can be used for reductions in aqueous media. It can also be used in other media--alcoholic or amine solutions--where lithium aluminum hydride is inapplicable. Lithium borohydride is generally comparable to the sodium derivative but is far more reactive toward water and moist air.

* * CI * *

Within a few months B. F. Goodrich Chemical Co., Cleveland, will be producing an important new beta-propiolactone derivative on large pilot-plant scale. Nature of the chemical won't be disclosed until Goodrich is prepared to supply drum quantities, but it is reportedly an intermediate with ultimate use in the textile, plastics, and allied fields.

The cheapest dibasic organic acid, carbonic acid, is the basis of a new series of ester-type plasticizers made by Ohio-Apex, Inc., Nitro, W. Va. First one, now being evaluated, is bis(dimethylbenzyl) carbonate, made by the reaction of dimethylbenzyl chloride with sodium carbonate in the presence of a tertiary amine catalyst.

* * CI * *

Product liability is becoming the No. 1 problem in agricultural chemicals. Private estimates place the total of liability suits now pending as high as $4 million. Big fear is that paying off without fighting cases on their merits may establish harmful legal precedents, force some companies out of business.

First of the large polish makers to introduce a silicone-base product is Boyle-Midway, Inc., New York. Its Autobrite has been test-marketed on the West Coast for several months, has had a sale in Philadelphia, and is now being readied for national distribution. Fair-traded at 98¢ for a 12-oz. bottle, the polish gives a water-repellent coating said to last six months or more.

* * CI * *

Late this month U. S. Rubber Co., New York, will introduce Enrup, a new thermosetting plastic believed by those in the field to be a combination of phenolic resin with acrylonitrile rubber. It is now being made at the company's Fort Wayne, Ind., and Passaic, N. J., plants.

Two new contenders in the acrylonitrile-fiber field? What may be a Chemstrand fibre is described in a patent (U. S. No. 2,498,605) assigned to Monsanto. It's a mixture of polyacrylonitrile and either maleic or succinic anhydride. American Viscose Corp. has patented (U. S. No. 2,499,501 artificial filaments from cyanoethyl cellulose, made by the reaction of acrylonitrile with cellulose xanthate.

* * CI * *

Here and There:

Commercial Solvents Corp. has resumed production of ethyl acetate at Agnew, Cal....In a few weeks Fels & Co., Philadelphia (Fels-Naphtha Soap), is expected to begin test-marketing its new heavy-duty synthetic detergent, Felso, in selected areas.

The Editors

Here's Complete Information on Koppers Synthetic Chemicals

FOR COMMERCIAL PRODUCTION

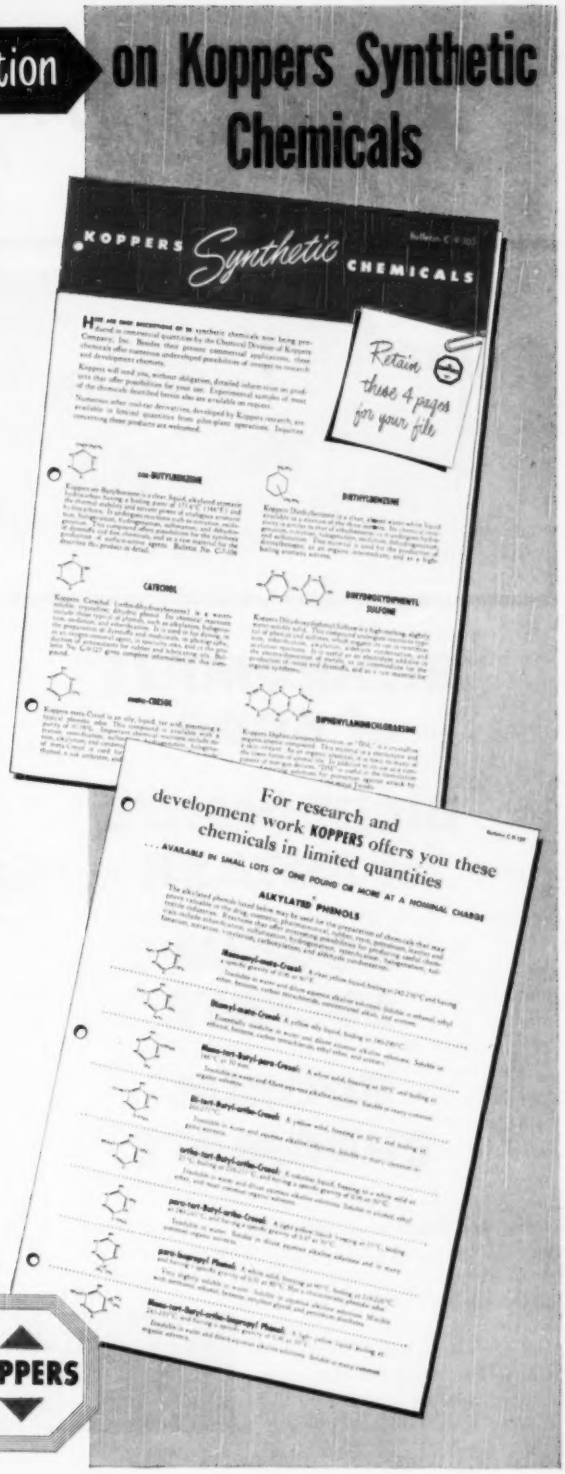
Bulletin C-9-103 lists the properties, reactions and uses of 26 synthetic organic chemicals produced in commercial quantities by Koppers Chemical Division. Most of these chemicals have established commercial applications, but are of interest as well to research and development chemists. This bulletin describes the following products:

- **sec-Butylbenzene**
- **Catechol**
- **meta-Cresol**
- **Diethylbenzene**
- **Dihydroxydiphenyl Sulfone**
- **Diphenylaminechlorarsine**
- **Di-tert-butyl-meta-cresol**
- **Di-tert-butyl-para-cresol**
- **Divinylbenzene**
- **Ethylbenzene**
- **Hydrocyanic Acid**
- **Hydrogen Cyanide, Industrial Grade**
- **Isopropyl Phenols**
- **beta-Methyl Umbelliferone**
- **Mono-tert-butyl-meta-cresol**
- **Nonyl Phenol**
- **Penacolite ® Adhesives**
- **Phenolsulfonic Acid**
- **Phthalic Anhydride**
- **Propiophenone**
- **beta-Resorcylic Acid**
- **Resorcinol**
- **Sodium Sulfite**
- **Styrene Monomer**
- **Sulfuric Acid**
- **Polystyrene**

FOR RESEARCH AND DEVELOPMENT WORK

Bulletin C-9-139 describes the properties of a group of synthetic chemicals available in limited quantities from Koppers pilot plant operations. Each of these chemicals offers possibilities for further research and development work in your own laboratories. The following products, available in small lots of one pound or more at a nominal charge, are described in the bulletin.

- **Monoamyl-meta-Cresol**
- **Diamyl-meta-Cresol**
- **Mono-tert-Butyl-para-Cresol**
- **Di-tert-Butyl-ortho-Cresol**
- **ortho-tert-Butyl-ortho-Cresol**
- **para-tert-Butyl-ortho-Cresol**
- **para-Isopropyl Phenol**
- **Mono-tert-Butyl-ortho-Isopropyl Phenol**
- **Di-tert-Butyl-ortho-Isopropyl Phenol**
- **ortho-(alpha-Phenethyl) Phenol**
- **para-(alpha-Phenethyl) Phenol**
- **ortho-(alpha-Phenethyl) para-Cresol**
- **Phenethyl Resorcinols**
- **Monochlororesorcinol**



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KOPPERS

THIS SHORTAGE CAN BE LICKED

by ***ROBERT L. TAYLOR, Editor***

THERE IS CURRENTLY A SHORTAGE in the chemical and related industries of qualified junior management personnel that promises to be almost as worrisome as some of the material shortages of wartime.

The full impact of this problem has been felt only during the past year or so. During that time, however, it has been brought home with shocking force to a handful of companies—less so to others, but still in sufficient degree to make it cause for fairly widespread concern.

The difficulty is not so much lack of numbers of young men from which to choose. With the exception of two of the war years the colleges have been sending a constantly increasing stream of graduates into the chemical industry. Rather the problem seems to be a lack of basic managerial qualifications within the eligible group.

Top chemical company managements today are realizing that the men who succeed them will need more than a sound technical background and a knack for getting things done.

They will need in addition a keen sense of the economic, social, and political tides with which business management everywhere is being forced increasingly to concern itself. They will need to learn the importance of long-range objectives, and of effectively coordinating and integrating current activities toward these ends. They will need to learn to recognize the not-always-easily-recognizable distinction between calculated risk and pure recklessness, between sound growth and over-extension, between prudence and stagnation. They will, in other words, need a full appreciation of the principles of sound business as well as an understanding of the chemical industry and how it operates.

There are several reasons for a shortage of up-coming chemical executive timber of this calibre today.

Most obvious is the fact that chemical production has tripled over the past decade. Such growth always puts a strain on the supply of seasoned managerial talent.

Probably equally important is the character of wartime managerial needs and the kind of managers it produced. During the war and immediate postwar years emphasis was on production, procurement, and technology. The need was for men who could accomplish material tasks—get things done, complete the assignment, whether it was to increase production rates, cut red tape, or smash a difficult technical bottleneck. Some of these wartime managers have been able to adapt their talents to present needs and continue up the ladder. Some have not.

Beyond these two reasons for the present shortage we wonder if there may not be a third—one which might well be scrutinized in the light of future growth requirements of the industry. That is the increasing emphasis by many chemical companies on technical knowledge in the young graduates they employ, regardless of the ultimate destinations of these men in the company. The insistence of some companies on specialized technical knowledge of one sort or another in almost all of the college graduates they hire has possibly tended toward an overloading of these companies with technical talent at the expense of a reasonable reserve of good men with broader interests. Perhaps, too, some of our scientific and engineering schools have been over-zealous in building technical-expert-worship at the expense of a healthy regard for other opportunities in industry that are open to men with technical backgrounds.

There would seem to be an opportunity at this time for the chemical industry to join hands with leading educational institutions in a planned program for training men to fill non-highly-technical jobs in the chemical industry. With chemical science in the advanced state that it is, it is impossible to design a single course of study that will satisfactorily prepare one man for a career as a first class scientist and another for greatest effectiveness in one of the many responsible chemical industry jobs that does not require expert technical knowledge.

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Specific Gravity.....1.047 to 1.049 at 20/20°C
Acidity:
Not more than 0.01%, calculated as phthalic acid
Water:
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Color.....Water-white
Odor.....None

Molecular Weight.....278.34
Distillation Range:
227° to 235°C at 37mm of mercury
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Specific Heat.....Approximately 0.43 cal/g/°C at ordinary temperatures
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What's new

STYRENE COMES OF AGE

Resin polymers, emulsion paints and styrenated oil displace GR-S as largest styrene users, but the industry faces a tough price problem.

THE oft-hospitalized styrene industry is in danger of receiving still another crack on the head in the form of increased prices. When such increases appear, they can be attributed directly to high-priced benzene.

Benzene is the principal raw material for making styrene, and the styrene industry is the largest single consumer of benzene. So the fortunes of each are intimately entwined with the other. The problem now is that Tweedledee is outdistancing Tweedledum.

The styrene industry is really faced with two benzene problems, a short-range one and long-range one.

Currently, as an aftermath of the long mid-winter coal strike, there is not enough coal-tar benzene at 22¢ a gal. to go around, and benzene users have had to resort to the new 40¢ a gal. synthetic material from petroleum (*CI, April 1949, p. 493*) to eke out their requirements. Since every boost of 6¢ in the price of a gallon of benzene means an increase of about 1¢ in the cost of making a pound of styrene monomer, the effect of very much 40¢ benzene on styrene producers is obvious.

This immediate problem, however, is probably a passing one, as there appears to be sufficient production of benzene from coke ovens to balance current demand provided the coke ovens are permitted to operate. Even the petroleum benzene producers admit this.

The real problem is the pell-mell rate at which the consumption of benzene has been increasing. And the trend of benzene demand continues up with no sign in sight of expanded supply other than the costly synthesis from petroleum. So even if present price pressure is alleviated, it appears to be but a matter of a short time until the best efforts of the coke ovens are permanently exceeded. This would mean, of course, an eventual stabilization of the price of benzene at a level that would permit profitable operation of the synthesis units. Current expectations are that this will be in the vicinity of 30 to 32¢ a gal. on the Gulf Coast and 28 to 30¢ a gal. in Chicago or Pittsburgh. Translated, this means 1 to 1.5¢ a lb. on styrene monomer now quoted at 15¢ a lb.

Because many uses of styrene are based on its low price, this will not be an easy blow for the industry to take. It will put cellulose acetate, for example, whose price has recently been reduced, in a much more favorable competitive position.

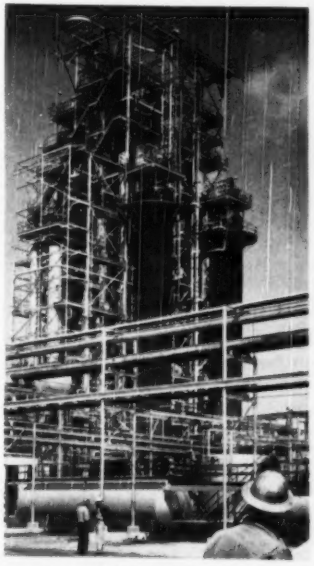
Growing Pains

But styrene has weathered storms before. It has sustained its full share of bumps and bruises in the process of growing up.

The production and sale of styrene started off with the usual cautious introduction and exploration for markets in 1931. In 1942, in mid-adolescence, it suffered its first growing pains. Uncle Sam's sea lanes to the rubber plantations of the Far East were blockaded by the Japanese, and it became necessary to create a synthetic rubber industry yesterday, if such a trick could have been performed. It was decided to base the rubber program on a butadiene-styrene copolymer, the present GR-S, which contains approximately 23% styrene. The operation was successful and a synthetic rubber industry was grafted onto the U. S. economy.

To provide the 23% styrene, production of that material increased tenfold in 1943 to 100 million pounds a year and was more than tripled the following year. An all-time high of 400 million pounds was reached in 1946. If production continues as it has over the past six months, this figure will be exceeded in 1950.

But the wartime expansion was not achieved without exposing the product to hunger in the form of a benzene shortage caused by the huge demands for cumene (propylene + benzene) for aviation fuel. Large benzene imports from England averted starvation of both.



STYRENE AT TEXAS CITY: One year and $16 million later.

Where It Comes From

The first styrene polymer found its way into the U. S. from Germany in 1928, but there was little material available when The Dow Chemical Co., now the largest producer, first began its studies in 1931. After much work a synthesis was developed which produced styrene from β-phenylethyl alcohol, which was produced from ethyl chloride and benzene. This proved too complicated, and in 1933 work on the present process began.

In this process benzene is ethylated with ethylene followed by dehydrogenation to styrene. Overall yield from benzene is reported to be about 90%. Thus the 1949 production of styrene required somewhat over 45 million gallons of benzene, nearly a third of the total coke oven benzene supply of 141 million gallons.

All of the war-born styrene plants used benzene and ethylene as raw materials with the exception of the one erected for the government by Carbide and Carbon Chemicals Corp.

which utilized acetophenone as an intermediate. This plant was purchased by Carbide at the end of the war and no longer makes styrene.

The present production pattern shows three producers: Dow, Koppers and Monsanto. The Monsanto plant at Texas City, Texas, has been restored following its devastation by an ammonium nitrate explosion on April 16, 1947.

U. S. STYRENE PLANTS

	Estimated Capacity (million pounds per year)
Dow, Los Angeles, Calif.**	72
Dow, Midland, Mich.	36
Dow, Velasco, Texas	192
Koppers, Kobuta, Penna.	90
Monsanto, Texas City, Texas	120*
Total	510

* Design capacity. Actual capacity probably somewhat higher.
** Dow operates as agent for Office of Rubber Reserve.

Where It Goes

Last year marked the coming of age of the styrene industry. It was the first year since the start of synthetic rubber production in 1942 that non-GR-S uses exceeded the requirements for GR-S. Styrene polymer production totaled 213 million pounds and requirements for synthetic rubber were only 163 million pounds, exactly reversing the production figures for the preceding year. By difference, the use of styrene for styrenated oils was 14 million pounds for 1949 and nine million for 1948. There is an error in these figures to the extent that no account is taken of the carryover stocks from the preceding year and the term styrene polymers includes the weight of some copolymerization agents. Nevertheless, as is indicated, the use for drying oils is increasing at an even faster rate than the production of polystyrene.

Another development whose styrene requirements could well equal those for styrenated oils in the use of latices of butadiene-styrene copolymers in emulsion paints (*p. 655*).

Even at current high production levels there appears to be room for further expansion in both polystyrene and styrenated oils. The use of synthetic rubber is beclouded by politics and the question concerning the value of "cold" rubber. Further, the price of natural rubber has been on the increase despite a six-months supply in the warehouse. And there is an excellent possibility that rubber manufacturers will increase the quantity of synthetic, now 29%, in their products.

Beclouding the whole picture, however, is the close race between benzene supply and demand, with the attendant bugaboo of higher prices.

POLYAMIDE EMULSIONS

Versatile resin yields to efforts to make water dispersions.

POLYAMIDE resins, formed by condensation of dimerized vegetable oil acids with ethylene diamine, have been carving a roomy niche for themselves in the heat-sealing resin market. Introduced commercially in 1947 by food-home appliance-chemical producer General Mills, Inc., they have worked their way into broad industry use as heat-sealing adhesives and as water-vapor, grease- and oil-resistant coatings for paper, plastic films and metal foils.

HAROLD WITTCOFF: Presided over a reluctant union.

But despite their rapid climb, the polyamides have given General Mills one small but persistent headache: They have been obstinate about going into water suspension.

Not to be outwitted by its own resins, General Mills assigned the problem to chemist Harold Wittcoff and W. A. Jordan, head of its Research Laboratories' applied research section. This month the successful results of their work, polyamide resin suspensoids, went into the pilot-plant.

Fast Dry, No Block

The new suspensoids are cationic. Remarkably stable, they are said not to coagulate even when repeatedly frozen and thawed. They heat-seal and adhere firmly to most materials. While their films are not continuous, they are solvent resistant and will fuse to become resistant to water, water vapor, and oil. The clincher: They dry rapidly and will not block even under severe pressure.

General Mills is not revealing how it turned the trick. But it believes the suspensoids will open broad, new fields for polyamide resins. To prove this belief, its pilot plant is now making polyamide resin suspensoids of two grades: A-000, an essentially uncompounded suspensoid, and B-200, which is modified for superior resistance to abrasion and to produce heat-seal bonds with improved stability at low temperatures.

Fred B. Speyer, of GM's new products commercial research organization, says that up to gallon samples of Polyamide Resin Suspensoids A-000 and B-200 will be offered for evaluation. Larger quantities from pilot plant production will also be available.

STILL ANOTHER PIE

Mathieson partner in $27 million petrochemical venture.

A YEAR AGO Mathieson Chemical Corp.'s expansion into sulfuric acid and phosphate fertilizers was described as putting its finger in more pies (*CI, April 1949, p. 564*). It apparently has grown to like the taste of new things, for it has just broken another crust: Final arrangements have been completed for a joint venture into petrochemicals with the shareholders of Tennessee Gas Transmission Co. (*CI Newsletter, April 1950*).

Mathieson Hydrocarbon Chemical Corp. is the name of the new $27 million company, president of which will be Mathieson's top man and prime mover in its diversification drive, Thomas S. Nichols. It will produce a number of chemicals—principal ones presumably ethylene oxide and glycol—from hydrocarbons which Tennessee will separate from the natural gas stream transported over its pipeline network (800-million-cu.-ft.-per-day capacity) from Texas and Louisiana fields to northern and eastern markets.

In Veep Country

Site of a $17 million chemical plant to be completed by the end of 1951 is 2,000 acres near Brandenburg, Ky., southwest of Louisville on the Ohio River. In addition to this the company will build a $6 million plant for production of raw material components at another location.

Tennessee Gas Transmission is also building a $12 million stripping plant near Greensburg, Ky., which will separate the hydrocarbons from the natural gas stream, lowering its Btu value from 1048 to 1033. A pipeline will

be constructed to bring them to the new Hydrocarbon Chemical units.

The decision to locate the chemical plant on Tennessee's pipeline in Kentucky assures the company of a long-term supply of a large volume of low-cost raw material at a point close to the principal markets for the new products. A major portion of the initial output of the new company has been sold on forward contracts to consumers in the chemical and petroleum industries.

NO TOSS FACTOR

New impact tester measures plastics strength more accurately than Izod.

HOW STRONG is a plastic? Actual use is one way to get the answer, and laboratory testing is another. Trouble is, they don't always agree. A case in point is wood flour-filled vs. mica-filled phenolic. Actual service shows that the former is more impact-resistant, but the latter does better on the Izod test. Obvious conclusion, since the proof of the pudding is in the eating: The test's no good.

The inadequacy of the standard Izod test has long been recognized, and the reason for it can be summed up in two words: "toss factor." In the Izod test a plastic piece cut to standard dimensions is hit by a swinging pendulum. The plastic breaks and the energy causing the break is calcuable from the weight and velocity of the pendulum. Except for one thing: The broken half of the specimen flies off at some unknown and unknowable velocity, carrying with it a certain amount of kinetic energy proportional to its density and known as the "toss factor." This unknown quantity should be substracted from the calculated energy.

BRYCE MAXWELL: Old figures are loaded.

Military Interest

The deficiencies of the Izod machine (and other machines since designed to eliminate toss factor) became apparent to L. F. Rahm and Bryce Maxwell, working at Princeton University's School of Engineering on a plastics research project sponsored jointly by a number of the military services.

One of the contract problems called for the synthesis of a material having the electrical properties of polystyrene and the impact strength of ethyl cellulose. Initial work on the problem involved formulation of many polymer specimens to be tested for impact strength. Izod values on these specimens were all in the 0.2 to 0.3 ft.-lbs./in.-of-notch range, but it soon became evident that about half of this energy was lost as toss factor. Rahm and Maxwell figured that if this extraneous factor could be eliminated, they'd have a better idea of where their synthesis work was leading them.

Merry-Go-Round

In the machine finally evolved by Rahm and Maxwell, the test specimen juts out from the edge of a flywheel. After the flywheel is spinning, the specimen is broken against a stationary anvil. The broken-off part of the specimen thus contains within itself the energy of toss and doesn't receive it from an outside source as in the Izod machine. A simple measurement of the change in speed of the flywheel during the break gives the data to calculate the impact strength.

Tests with the new machine have turned old data—"loaded" in favor of the heavier plastics—topsy-turvy. Here's a comparison of the old and the new, each figure representing the average of five specimens:

Material	*Izod*	*New Method*
Mica-filled phenolic	0.30	0.12
Wood flour-filled phenolic	.22	.13
Alpha-cellulose melamine	.27	.14
Alpha-cellulose urea	.30	.16
Mineral-filled alkyd	.37	.17
Asbestos-filled phenolic	.32	.18
Polystyrene	.22	.18
Methyl methacrylate	.28	.23
Chopped phenolic paper	.57	.54

Rahm and Maxwell have built two improved models of the machine in addition to the one described to the A.S.T.M. last June, and they have supplied blueprints for the use of various branches of the armed forces. It's still in the hand-built stage, but commercial equipment manufacturers are considering it for production.

R. R. HOWARD: He bought a lot.

BEAUTY KIT FOR CARS

Hollingshead groups automobile reconditioning products into "Carsmetics" line, spurs sales to used car and truck dealers.

USED CAR DEALERS may be moaning about a buyer's market this spring, but they should find some sunshine in a new line of automobile reconditioning products R. M. Hollingshead Corp., Camden, N. J., has just introduced to the trade. Boasting several novel numbers and the equally novel name "Carsmetics," the assortment has been planned to add dollars to the resale value of cars while paring reconditioning costs.

Using these materials in a 21-step procedure, a dealer can completely recondition trucks or cars without need for specialized tools or expensive labor. This means more sales of cars —and of Hollingshead's Whiz brand automotive specialties.

Growth of an Idea

Man responsible for Carsmetics is Robert R. Howard, the company's director of specialty sales, who for years has been trying to awaken used-car dealers to the profit possibilities in reconditioning. While working for a large automobile refinishing house back in 1938, he pooh-poohed dealers' contention that reconditioning costs were too high to justify the necessary investment, bought himself a lot in Youngstown, Ohio, to prove his point. In a year he was moving more used cars than anyone else in the area—at higher profits—because his cars were properly painted when they required it, were completely reconditioned inside and out.

Just about the time the war started, he set up a business in Cleveland to recondition used autos for dealers in that area. Because reconditioning products he required were not then available, he started manufacture for his own use. He soon was able to bring reconditioning cost (excluding overhead) down to $14.02 a car, and the reconditioning program became so popular he decided to confine his efforts to manufacturing, and make these products on a national scale.

Shortly afterwards, the Howard Line of reconditioning items made its debut on a modest scale. Howard was able to make a good start in the reconditioning business, but his limited capital and small sales force were drawbacks. So in 1948 he decided to tie up with a company with greater resources, and joined Hollingshead where he has helped guide the development of the Carsmetics line. Some of his early products are in the new line unchanged, others have been improved upon, and new ones have been added.

Even Smells New

Among the new items developed in a laboratory program under Hollingshead's new products development director, Al Moore, are a spray tint to restore faded upholstery; convertible top coating that can be sprayed with a gun; plastic spray coating for seats, head linings, paneling; chrome refinishing kit comprising metal powder which is dusted onto a base coat with a powder puff; and a new car odor to put the final touch to the job.

Mainstay for body and fender repairs is Met-L-it, a moldable alloy which dries to a hard metal. This was introduced separately only last summer. Other products in the reconditioning program are designed to degrease motor, refinish steering wheel and garnish moldings, clean and wax exterior, refinish rubber surfaces and refinish engines and under-hood parts.

Auto Shows and Clinics

Shown for the first time at the National Automobile Dealers Show in Atlantic City earlier this year, the Carsmetics reconditioning program is being demonstrated at similar shows in different sections of the country. Demonstration clinics have shown dealers how the line should be used, and over 800 distributors have been selected on the basis of size, number of salesmen available, and willingness to conduct such clinics. Distribution is limited to car and truck dealers, garages, and service stations, and probably won't be extended to automobile accessory stores.

Establishments that meet certain standards in using Carsmetics may affix the Whiz Sanitizing Seal to reconditioned cars and trucks. This certifies that a thorough job has been done in accordance with Hollingshead's approved methods and products.

Chevrolet has just held a series of recondiioning clinics for its dealers in which Hollingshead was invited to participate with Carsmetics. While General Motors refrains from "endorsing" Carsmetics for use by Chevrolet dealers, Hollingshead feels that being the only manufacturer whose products were so recognized at these clinics is tantamount to endorsement. In fact, Chevrolet has prepared 8500 sets of catalogs for its dealers recommending a procedure in applying these products. Several other car manufacturers are also interested, and Carsmetics may soon be available to their dealers under either their own or the Whiz label.

SEEING MOLECULES

Electron micrograph technique permits seeing and measuring of polysilicone molecules.

MOLECULAR models assembled by chemists look no more like molecules than a crude map of a county resembles an aerial photograph. Still, it was shown recently by brothers Theodore and Eugene Rochow, of American Cyanamid Co. and Harvard University, respectively, that there's more to a molecular model than meets the eye.

They were interested in the size of silicone polymer molecules. The usual method—measuring the osmotic pressure of a solution—was impracticable, for the higher polymers were insoluble (and besides, nobody knows whether or not the molecules may be broken apart by the process of solvation).

Mapping the Surface

So they decided to have a look at the molecules themselves. This they did by applying the techniques of resinography (*CI, Dec. '48, p. 964*)—a branch of plastics chemistry akin to metallography and crystallography.

It is reasonable to assume that when a plastic specimen breaks, it cleaves between the polymer molecules rather than breaking the stronger bonds between the atoms within the molecules. Studying the magnified surface of a fracture, then, should show something about the giant molecules constituting the plastic.

In practice this is done by chilling the plastic until it is brittle, breaking it, and casting a negative replica of gelatin or polyvinyl alcohol film. Silica is then evaporated onto the film in a vacuum evaporator, and the soluble film is dissolved away, leaving a positive replica. The final product is then ready for electron micrography.

The electron microscope gives magnifications up to 20,000, and photographic enlargement makes a 100,000-fold magnification possible. At that enlargement 100 Angstrom units show up as one millimeter.

Seeing the Silicone

Applying these techniques to a sample of silicone rubber, the Rochows

TED AND GENE ROCHOW: The brothers laid down a rule.

MACROMOLECULES: Pi and sp. g. are enough.

obtained from their friends and electron microscopists Martin Botty and Frederick Rowe photos with clearly visible "grains." The larger grains were elliptical, measuring about 0.93 mm. by 3.7 mm. The smaller grains were more nearly spherical, from 0.93 to 1.9 mm. in diameter. Still smaller ones could be seen, but they were difficult to measure. Taking a representative grain of 1 mm. diameter (which corresponds to 100 A), the Rochows could easily calculate the volume of the sphere as about 520,000 A^3.

Knowing the specific gravity of the silicone resin (0.972), it could be calculated that the gram-molecular-weight of the sphere was 304,000.

A previous investigator had calculated from molecular models that a single unit of dimethylsiloxane (of which this rubber was composed) should occupy a volume of 3 x 7 x 6 A, or 126 A^3. Dividing this figure into 520,000 A^3 gives 4,120 dimethylsiloxane units per molecule. Each such unit has a gram molecular weight of 74.1, so the gram molecular weight of the polymer molecule turns out to be 306,000. It seems pretty likely, then, that the 1-mm. sphere observed in the photograph was actually one macromolecule of silicone resin.

Although these techniques are not simple, they open previously closed doors in resin research: First, molecular shape and size are pictured rather than merely inferred. Second, measurements are direct and practically no assumption need be made. Finally, the method is applicable to all high polymers, whether they are soluble or not, whether they are compounded or not, whether they are pure or not.

CARBON PLUS

Godfrey L. Cabot, Inc. enters plasticizer field with line of general purpose and special plasticizers.

PRODUCT diversification has been the aim of many chemical companies since the war. New avenues permit greater corporate growth, and the resultant broader base makes for smoother sailing in economic storms. On the surface, the paths taken often seem too diverse to make much sense; yet the inside story is likely to be as logical as an Erle Stanley Gardner plot when the final unraveling takes place.

Cabot's recent entry into organic chemicals (*CI Newsletter, March, 1950*), is one of those stories. Here is a leading producer of carbon black, over a billion-pound-a-year material, the bulk of which sells for 3 to 10 cents a pound, now making organic chemicals that sell in the 30-to-40 cents a pound range. Why did the company decide to make these materials? What experience does it have in this field? Who are its customers?

Same Customers

The latter question is one of the keys to Cabot's decision. Over ninety percent of its black business is to companies who use rubber, and with all these companies going into vinyl plastics, it seemed wise to manufacture products that could be sold to these accounts. Moreover, the consumption pattern for both rubber and vinyls is the same: about one-third of carbon black or plasticizer by weight goes into the final product.

When its plasticizer research and development program was instituted in 1947, Cabot hired Dr. W. B. Pings, an organic chemist, and set a crew of young chemists and engineers with fresh M.I.T. degrees to work developing new primary plasticizers and special secondary plasticizers. The aim was—and still is—not only to compete in standard materials, but to slant its effort toward new high-quality plasticizers and special sales service.

As a start, the company began making small quantities of di-iso-butyl adipate, a standard plasticizer sold mostly for rubber use. Then in the fall of 1948, the Enjay Co. came along with its iso-octyl alcohol produced by Esso Standard Oil Co. by the Oxo process (*CI, August, 1948, p. 211*) and the opportunity to manufacture plasticizers from this petroleum-based alcohol presented itself. Di-iso-octyl phthalate and di-iso-octyl adipate became part of the Cabot line, and volume production began last fall.

In choosing Enjay's Oxo alcohol, Cabot feels it has picked a winner. Cabot shares Enjay's confidence in its ability to compete with 2-ethyl hexanol and, with early production difficulties overcome, states that its present di-iso-octyl phthalate (Cabot's Di-OP) can't be beat for quality. Product specifications seem to bear it out: it is odorless, has an acid number under .01 and is water-white (APHA maximum of 20).

Sitting Pretty

Cabot is in a good position to sell the plastics industry on the advantages of Oxo-derived plasticizers. Sixty percent of the industry is located in the New England-New Jersey-New York area, and Cabot has its sales offices and research and development laboratories in Boston, with production facilities in nearby Cambridge, at present turning out the three standard plasticizers being offered. For the long run, its plants in Texas and Louisiana will probably produce these plasticizers closer to the source of the alcohol at Baton Rouge.

Despite its sales of standard plasticizer this year, Cabot has not let its original objective of making new plasticizers become clouded. It has a new one called Plasticizer PGA which is just being introduced. This has low volatility, superior heat-aging properties, and is efficient. In addition, it has a stabilizing effect when used in conjunction with other plasticizers such as tricresyl phosphate and di-octyl phthalate.

Future developments will include vinyl stabilizers, secondary plasticizers and extenders—products that can be readily integrated with Cabot's present sales pattern.

ACS BRIEFS

● SULFUR, phosphorus, arsenic, and silicon compounds have been found to interfere with anti-knock agents, reports H. K. Livingston, of Du Pont. Sulfur compounds, fortunately, are the only ones that occur to a significant extent in gasoline raw materials.

● OIL FIELDS in the Rocky Mountain region contain a 6½-million-ton reserve of sulfur as hydrogen sulfide, says R. H. Espach, U. S. Bureau of Mines. This could support a 500-tons-a-day sulfur output for 25 years and provide enough sulfuric acid for the establishment of heavy industry in that region. Phosphate, petroleum refining, and metallurgy are likely prospects.

SEAFORD, DEL., NYLON PLANT: A cradle in one corner.

"V" UPS p-XYLENE NEEDS

Fiber V, being test-marketed by Dupont, brings tonnage production of two new chemicals: para-xylene and terephthalic acid.

TEST-MARKETING of such varied items as window curtains, sport shirts, and men's suits marks another step in commercialization of Fiber V, Dupont's newest entry in the fast-moving synthetic fiber field.

This product is Dupont's variant of the linear polyester of ethylene glycol and terephthalic acid, first discovered by the British Calico Printers Association and later developed in conjunction with Imperial Chemical Industries under the name Terylene (*CI, May 1947, p. 764*).

Although Dupont states that commercial production is not yet definitely assured, the development has already resulted in a new tonnage chemical, terephthalic acid, and is making its precursor, para-xylene, available in tankcar lots.

Terephthalic Acid

The acid is obtained from para-xylene by oxidation. Dupont declines to say where its initial xylene oxidation unit is being located or to mention process details. However, the Explosives Department is carrying out the operation, and industry sources believe the place to be Gibbstown, N. J. The present Gibbstown plant has sizable nitric acid capacity over and above its own needs, and this conceivably could be used to provide acid for xylene oxidation.

The necessary ethylene glycol presumably will come from the Belle, W. Va., plant of the Polychemicals Department.

Judging from the patents which have been issued to Dupont, the polyester molecule is formed by first esterifying terephthalic acid with methanol, followed by alcoholysis with ethylene glycol to form the highly viscous polymer, ethylene glycol terephthalate. The viscosity is so high that solvent spinning rather than melt spinning will undoubtedly be used.

p-Xylene

Large-scale production of the raw material for terephthalic acid—*p*-xylene—represents no small accomplishment in itself.

At first there were worries that *p*-xylene could not be separated economically from the two other xylene isomers and ethylbenzene in the so-called xylene cut from petroleum. Until recently, in fact, price of the para isomer was a round $1 a pound. But now Oronite Chemical Co., the only producer, is offering para for 35¢ a pound in tankcars f.o.b. Richmond, Calif. When production really gets rolling it expects this figure to be reduced.

Like Dupont, Oronite is chary of process details beyond noting that the separation of the *m*- and *p*-xylenes is accomplished by a fractional crystallization technique.

Other petroleum companies have the necessary raw material for *p*-xylene production, but Oronite appears to have the field to itself for the time being. Both Shell Chemical Co. and Esso Standard Oil Co. have taken long looks at the product but thus far no more than that.

Meanwhile experimental work on the spinning of Fiber V has been going forward in a corner of Dupont's nylon spinning plant at Seaford, Del. Work on fabric production is a cooperative project between Dupont and various fabric producers and processors.

Marquisette curtains produced from Fiber V by Cameo Curtains, Inc., are being test-marketed in twenty different cities through the country. Men's sport shirts made by Bartlay, Ltd. have been tried out in Miami; men's suits have been tailored by Mansure & Prettyman in Wilmington, Del.

Fiber V's good strength characteristics, light stability, warm feel, and low water absorption should fit it well for these applications—and provide a growing market for two of industry's newest tonnage chemicals.

RESEARCH PULSE

Evans Research and Development Corp. quizzes industry on research policies.

IN ITS third annual report on industry's research requirements, Evans Research and Development Corp. sent out 2400 questionnaires to a cross-section of American industry, set to work compiling statistics from the 500 that were returned.

Chemical research, it appeared, will continue to expand if the national economy remains the same. Most companies (70%) will do the same amount as now, some (26%) will increase, and only a fraction (4%) will do less research.

An identical majority (73%) would proceed normally in a boom, keep its technical staff in a bust, and would not "farm out" more projects to outside organizations if they did have to cut their own staffs.

If research budgets had to be cut 38% would lop off fundamental research first, 17% would cut most on new product and process research, and 7% would cut on research leading to improvements in existing products and processes. The remainder (38%) would cut the three categories equally.

Three-fifths of the chemical companies use outside research organizations. Largest percentage (41) of companies use them mainly for new product research. Fundamental research serves a smaller proportion (31%); product improvement and process research trail (17% and 11%) among farmed-out projects.

The chemical industry guessed that the military preparedness program would affect research and development

more than it has. Only a third of the companies were affected to any extent during 1949, although two-thirds of them guessed the year before that it would. Affect of the program on their research plans for 1950 was predicted by 44%.

GENTLE STRIPPER

New process strips color from wool with little loss in strength or resiliency.

NO INDUSTRIAL CONSUMER is more cost conscious than a wool user these days. Prices are high, and all grades of wool are tight. He can't do much about the size of sheep flocks nor the amount of wool they grow on their backs, and increasing the yardage in a given quantity by use of waste has been hampered by the trend toward pastels. That's why the textile industry is interested in a new color stripping process for wool developed by Milton Harris, head of Harris Research Laboratories, on which Alexander Smith & Sons Carpet Co., Yonkers, N. Y., has just been granted an exclusive license.

Not that recovering wool waste by color stripping is anything new, for it has been standard practice for years. But most processes for removing color from waste yarn or fabric also damage the fiber to some extent, and limit the amount of recovered material that can be blended with virgin wool to produce new fabric. The new process, called Harristrip after its inventor, is claimed to leave wool with strength and resiliency unimpaired and in many cases more desirable than virgin wool in that it is less vulnerable to damage by subsequent dyeing and processing.

Unbroken Link

Chief cause for loss in strength of wools by action of chemicals is destruction of the disulfide linkage in the wool molecule. (Wool fiber consists of long peptide chains bridged by cystine and salt linkages.) Harristrip involves "rebonding"—replacing the cystine linkage with one that is not affected by subsequent treatment.

Rebonding is accomplished by reacting the waste wool with ethylene dibromide. The compound is added with sodium hydrosulfite or some other reducing agent to a bath buffered with borax (rebonding takes place only in alkaline medium) that has been heated to 190° F. Temperature is maintained for 15 minutes, or longer, depending upon the stock and modification of process being used. This treatment alone may be sufficient for destroying some dyes, but if stronger action is required, further stripping with standard reducing agents—zinc hydrosulfite (neutral), sodium hydrosulfite (alkaline) or zinc sulfoxylate formaldehyde (acid) may be employed.

Because the process protects the vulnerable part of the wool molecule and allows harsher conditions to be employed, it is somewhat more effective than other methods. It too, however, is limited by the efficacy of the color reducing compounds—the same ones the other processes use. Chrome black, for example, still can't be stripped.

Carpets as a Starter

Alexander Smith got into the picture a few months ago when Harris granted the company an exclusive license in the carpet industry on the new process. (A patent, on which a continuation in part has been filed, is due to issue soon. Harris states the basic claims have been allowed.) The company carried out mill development on Harristrip, evolving practical tests for its application and tying it in with use of color in weaving. Alexander Smith mills are now producing stripped wool at the rate of over a million pounds a year. Because of this work, the company now has an exclusive license throughout the textile industry with the right to sublicense the process.

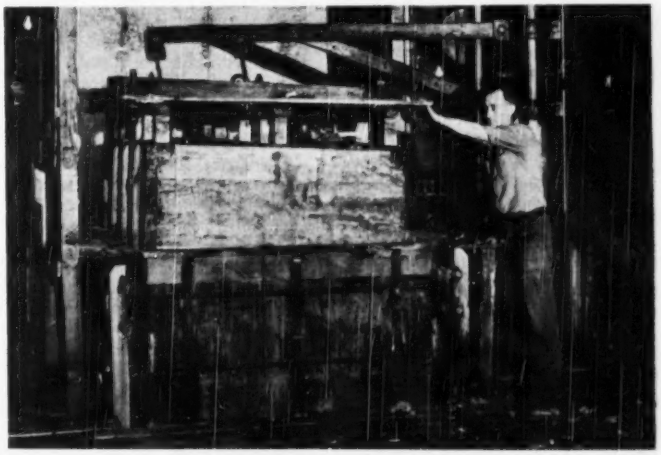
Switching over from other stripping methods is a relatively simple matter since conventional mill stripping equipment is used. The danger from breathing vapors of the halogenated bonding agent must be guarded against, but that merely requires hooding kettles or overflow tanks. There is no special waste disposal problem, as the material is exhausted during the process. Costs are comparable to those of other processes.

Because of the complex nature of the textile industry, each potential licensee will present a different problem. The carpet company hopes to develop a packaged plan that will cover all possible modifications, and is at present working with Harris on this phase of the project.

Close to Virgin

Alexander Smith, itself with long experience in use of stripped wool, points to the low alkali solubility (a test for cystine link damage) of wool processed in this fashion as proof of the method's advantages. Virgin wool runs 9-12%, and when acid dyed may run 13-15%; normal for Harristrip wool is about 13.5%, which on redyeing may go to 15%. Some of the stock the company used to purchase would run over 20%—considered by many the danger point—and occasionally ran as high as 40%. Bureau of Standards wear tests have substantiated the low damage indicated for Harristrip by alkali solubility figures.

Harristrip's effect on the market for chemicals may result in a greater demand for stripping chemicals. There is no chance for tie-in of packaged chemicals, however, since these are all standard items. Alexander Smith will be concerned with installing and servicing the process to fit in with individual operations—and collecting royalties.



HARRISTRIP: Rebonding protects the wool.

UNDERGROUND BATTLE

Long-term tests rank metals on resistance to underground corrosion.

KNOWING what kind of pipe to bury so there will be no ghostly worries about how soon it will have to be disinterred and replaced means much more than just one less headache for the plant engineer. Losses due to underground corrosion of pipe storage tanks and other metal structures run into hundreds of thousands of dollars a year.

Much valuable data on the resistance to underground corrosion of a wide variety of ferrous and nonferrous metals and their alloys is now in the process of being analyzed by the National Bureau of Standards, Washington, D. C. The data are the culmination of a long series of experiments by the Bureau involving approximately 3,000 specimens of pipe materials exposed to many kinds of soil corrosion for periods up to 14 years. Under the direction of Irving A. Denison and Melvin Romanoff, the work was conducted at 15 widely separated sites throughout the United States.

At the time the study was started in 1922 little was known regarding the corrosiveness of soils, and the occasional failure of metals underground was attributed to the discharge of stray electric currents in the earth or to other factors, such as high acidity. It was found early, however, that corrosion of ordinary types of iron and steel in soils is much more general than had been supposed and that corrosion is a natural consequence of the normal physical, chemical, and biochemical action of soils on metal surfaces.

Non-Ferrous Metals

In 1932 further tests were initiated to include such inherently corrosion-resistant metals as copper, copper alloys, lead and stainless steel.

These tests have indicated that copper and its alloys with zinc, silicon and nickel are highly resistant as a group to corrosion in soils which are very corrosive to ordinary iron and steel. Soils high in sulfides corrode copper at appreciable rates, but low-copper brasses are very resistant, although in the tests they were susceptible to dezincification which resulted in the formation of local areas of spongy copper. This type of corrosion, it was found, can be prevented by the addition of a fraction of one percent of arsenic.

Inspection of soldered copper tubing revealed no indication of galvanic corrosion of the soldered joint, even after exposure of 14 years. Specimens arc-welded with welding rods of the same nominal composition as the pipe gave no indications of accelerated corrosion in the vicinity of the weld. However an additional source of galvanic corrosion of copper arises from the possibility that oxides formed in welding operations may impart to the weld a potential that is cathodic to a pickled copper surface.

DISINTERRED PIPE: Old ideas crumble.

Lead showed uniformly good resistance, regardless of the presence of impurities, except in poorly aerated soils.

Ferrous Metals

Of the ferrous metals only steels containing at least 18% Cr and 8% Ni were wholly resistant to corrosion. Plain chromium steels are subject to severe pitting. Cast iron, plain or alloyed with nickel or nickel and copper, did not show as severe corrosion as chromium steels, while wrought iron pipe was intermediate between the two.

The fact that stainless steel is the only one of the ferrous materials to resist underground corrosion is believed due to conditions in soils which do not favor the formation of tight, adherent rust deposits. However, it must be remembered that immunity to corrosion shown by small test specimens does not necessarily mean that a large structure of the same material will last indefinitely. The effect of expanding area on the depth of pitting, which in the case of plain iron and steel is well understood, has not yet been worked out for the high alloy steels.

The one environmental condition which has a predominant influence on pitting and weight loss with time is aeration. Because the initial rate of corrosion of metals in soils is in general determined by the accessibility of oxygen to the metal surface, this rate must necessarily be considerably greater in well aerated soils than in poorly drained soil deficient in oxygen. However, oxygen in excess of that required for depolarization of hydrogen causes the formation of layers of corrosion products in close contact with the corroding areas with the result that the corrosion rate is soon substantially diminished if not actually reduced to zero. On the other hand, in a soil containing no more oxygen than is required to maintain a low rate of depolarization, the products of corrosion diffuse outward into the soil and have little or no effect on corrosion rate.

A high initial rate of corrosion which soon decreases may not shorten the life of a buried structure as much as a low initial rate which shows little or no decrease with time. In soils in which the corrosion rate of a metal diminishes with time, an efficient means of combatting corrosion is to provide adequate thickness. If, for example, a section of pipe is exposed to condition which soon induce a virtual cessation of corrosion rate, the life of the pipe might very well be made infinite simply by doubling the wall thickness. On the other hand, if by doubling the thickness of the metal only a two-fold increase in useful life could be secured, the cost of the extra thickness would not be economically justified and some other means of combatting corrosion, such as a protective coating, would be indicated.

ACS BRIEFS

● CARBONATION of cane sugar juice at the mill, to eliminate the necessity of shipping raw sugar to refineries for further purification, was suggested by Pieter Honig, West Indies Sugar Corp. This is done at practically all beet sugar plants, but the only cane sugar mills using the process are in Java and Jamaica.

● SUGAR SPOILAGE in boneblack filters and in liquors treated with activated carbon has been a mystery. Now research by William L. Owen, consulting bacteriologist of Baton Rouge, La., has proved it to be the work of thermophilic bacteria. They apparently thrive in the presence of carbon, for inoculations of sugar with the bacteria in the absence of carbon caused no deterioration.

SPENCER GROWS

Expenditure of $6 million will make Spencer Chemical Co. first in natural-gas ammonia.

FIRST of this month Spencer Chemical Co., Kansas City, Mo., took possession of the Ohio River Ordnance Works, Henderson, Ky., and portions of the Indiana Arsenal, Charlestown, Ind.

The former, purchased from the U. S. Government, is now set up to produce 56,000 tons a year of synthetic ammonia from coke. Spencer will make the necessary modifications to operate it on natural gas.

The latter, occupied on lease from the Government, consists of a nitric acid plant and an ammonium nitrate neutralizing plant.

Purchase and lease of these plants, together with the construction of additional facilities there and at Spencer's Jayhawk plant, bought from the Government in 1948, will cost in the neighborhood of $6 million.

First in Gas Ammonia

Acquisition of the Henderson plant for about $3 million (for which Spencer was the sole bidder) makes the company foremost in capacity for ammonia from natural gas. The Pittsburg, Kans., plant has an annual capacity of 140,000 tons, and the addition of 56,000 tons at Henderson pushes the total to 196,000. Spencer will still be third to Solvay and Du Pont in total capacity, however, since those companies make a great deal of ammonia from coke.

Spencer plans to install natural gas reforming facilities to convert the plant to operation on that raw material, and it has obtained a commitment from Texas Gas Transmission Co. to supply its needs. Coke-using facilities will be retained to provide an alternate raw material if desired.

Teamed with Charlestown

Facilities will be installed at the Charlestown plant for making Spensol, Spencer's ammoniating solution. Ammonia will be supplied by the Henderson plant and thus the two plants will be teamed up, in effect, to operate as an integrated producing unit.

As it presently stands the plant has a design capacity to produce 9,000 tons of ammonium nitrate solution per month.

Where's the money coming from? That question is being discussed by Spencer's top brass at the moment. One or more of these alternatives are envisioned: a $2 million loan; issuance of additional preferred stock; sale of such assets as oil and gas interests; or company funds.

Spencer admits that its profits will be less for 18 months or two years while conversion and improvements are under way. Thereafter, the new properties are expected to pull their weight.

ACS BRIEFS

American Chemical Society meetings at Houston, Philadelphia and Detroit evoke papers of interest.

• ETHYLENE OXIDE is dangerous in the presence of water and caustic soda, warned P. P. McClellan, Jefferson Chemical Co. Two violent explosions in Germany were traced to the exothermic formation of ethylene oxide sludge in the presence of caustic and moisture.

• MONOMOLECULAR LAYERS of radioactive material give a purer, more standardized radiation than three-dimensional solids. Such two-dimensional emitters have been developed by Dietrich E. Beischer, U. S. Naval School of Aviation Medicine, Pensacola, Fla.

• A CARBON-COBALT CATALYST dimerizes ethylene to *n*-butylene in a process perfected by Shell Development Co., Emeryville, Cal.

• A SYNTHETIC LUBRICANT described by chemists of Socony-Vacuum Oil Co., Paulsboro, N. J., is polydecylene, an oil made by thermal, noncatalytic polymerization of decene-1. Reaction takes 10 hours at 650° F under pressure. Viscosity index of oil is 140; pour point, —10° F.

• ONLY A SMALL fraction of the quarter-million plants listed by botanists have been analyzed for their chemical components, asserts A. J. Haagen-Smit, California Institute of Technology, winner of this year's Fritzsche Award. A more thorough study would improve the flavors of foods and undoubtedly uncover valuable chemical raw material sources.

Pharmaceutical

• AUREOMYCIN, now used as an antibiotic, is also a potent growth accelerator for hogs and poultry, report scientists of Lederle Laboratories Division, American Cyanamid Co. Reason is not known, but it may be that it inhibits growth of detrimental organisms in the intestines. An increase of 50% in growth rate of hogs has been observed.

• A SEQUESTERING AGENT, ethylene *bis*-iminodiacetic acid, slows down clotting of blood stored for transfusions but increases clotting power within the body, report technical men of National Drug Co., Philadelphia. This is an ideal combination of properties for transfusion patients.

• A VETERINARY CREAM developed by Foxlyn Laboratories, Mountain Lakes, N. J., is a fungicide, bactericide, and deodorant, and it also promotes healing and stops insect bites from itching. Based on cyclohexyl pyroborate, the cream does not mat the fur of animals.

• THIOSEMICARBAZONES, a series of compounds developed in Germany, have been tried against tuberculosis by E. R. Squibb & Sons, New Brunswick, N. J., with results equal to those of streptomycin. The thiosemicarbazones have the advantage of being administered orally.

• A DRUG developed by G. D. Searle & Co., Chicago, treats peptic ulcer by blocking the nerve impulses that cause gastric muscle spasms and excess secretion of acid.

• IMPROVED EXTRACTION of nordihydroguaiaretic acid, widely used as an antioxidant in foods and pharmaceuticals, is claimed by John Page, Texas A. & M. Creosote bush leaves are extracted with isopropyl ether, either alone or in a mixture with carbon tetrachloride.

Water and Sewage

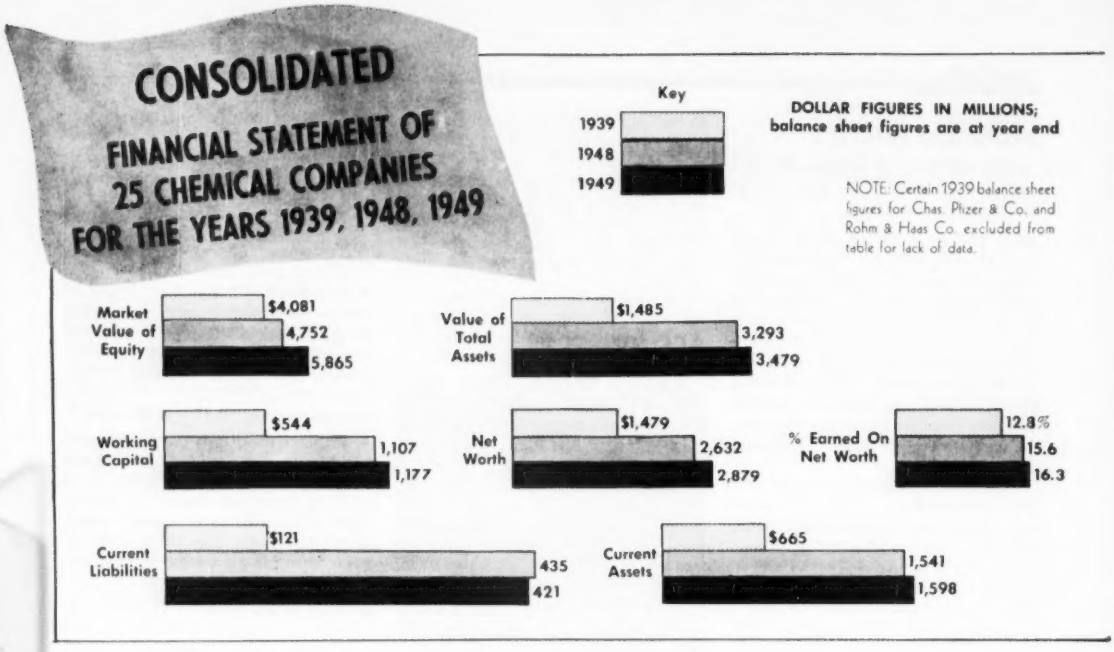
• POURING MOLTEN blast furnace slag into waste pickle liquor not only evaporates water from the liquor and reduces its acidity, but also gives a granular, porous slag that can be dried, crushed and sold for incorporation into fertilizer mixtures to reduce acidity and prevent caking, according to a process described by S. S. Heide, Tennessee Coal, Iron and R. R. Co.

• LOW-VOLTAGE direct current provides metallic ions for coagulation and removal of impurities in water without addition of foreign substances in a water treatment process described by Paul G. Stephan and A. C. Brumley, Alhydro, Inc., Baltimore.

Polymers

• INCORPORATION of carbon black improves the weathering of polyethylene insulation, say V. T. Wallder *et al*, Bell Telephone Laboratories.

• MASTERBATCHING of cold rubber with high-abrasion furnace blacks is now being done by U. S. Rubber Co., say J. W. Adams *et al*. Longer life for rubber is claimed over the previous dry-mix process.



1949: A Year of Progress in Chemical

Digestion of Postwar Gains Presents

A SOLID FINANCIAL PICTURE

by MICHAEL PESCATELLO*

SALES OF LEADING COMPANIES remained at high levels, while profit margins and income showed marked improvement in most cases.

ANALYSIS of the operations of twenty-five chemical companies in 1949 reveals that there were few changes of significance over the 1948 figures.

There was, however, one striking difference which has very real interest to both managements and investors. At the end of 1949 the market was valuing the common stocks of these twenty-five chemical companies at $5.8 billion. This figure was $1.1 billion higher than the market valuation of the same twenty-five stocks at the end of 1948. The significance of this change is emphasized by the fact that volume of business done by the companies remained approximately the same in both years.

In the year 1949 the leveling off process witnessed in the previous year continued. This was evidenced perhaps in a more emphatic way in capitalization changes. Both debt and preferred stock outstanding were almost exactly the same at the end of 1949 compared with 1948. The only material change occurred in the cases of Mathieson Chemical, which doubled its debt to $20 million, and Pennsylvania Salt, which increased it to $5.5 million from $3 million.

The vitality and strength characteristics of the chemical industry is revealed in the 1949 figures of twenty-five representative companies. Their sales increased by $8 million to $3,432,000,000 and there was a greater improvement in operating profit margins and net income. Industry generally experienced a decline of about 10% in sales and net income while profit margins also declined. Indices of production in 1949 reveal the strong position of the chemical industry in two ways, viz., (1) the almost negligible decline in the 1949 index compared with 1948 while industrial production fell by about 7%, and (2) in 1937 the industrial production and chemical production indices were approximately the same, but in 1949 the latter was considerably above the index of industrial production. The comparison is shown below:

FEDERAL RESERVE BOARD INDEX OF PRODUCTION
(1935-39 = 100)

	Industrial Production	*Chemical Products*
1937	113	112
1948	192	254
1949 (Dec.)	180	246

The relatively better performance of the chemical group was also accomplished without the benefit of an inflated price structure. The bureau of Labor Statistics Index of Chemical Products prices (1926 = 100) at the end of 1949 was 118 compared to 155

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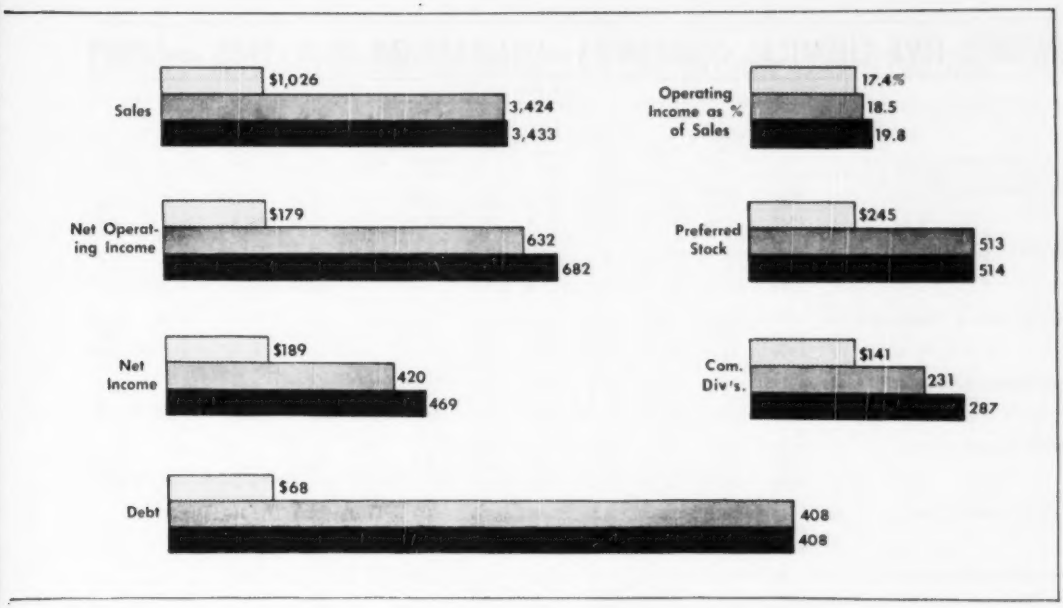


Industry Development

for all commodities. The index of raw material and manufactured product prices was 163 and 151 respectively. Chemical product prices were the lowest of any of the major groups compiled by the Bureau with the exception of the "miscellaneous" category.

INCOME HITS NEW HIGH

Last year the twenty-five companies, in the aggregate, reported record sales and profits. Sales of $3.4 billion were nearly three and one-half times greater than the $1 billion volume for 1939. Net income last year amounted to $469 million which was 148% greater than the $189 million net income reported in 1939 by these twenty-five companies. The increase in net income was materially less than the 281% increase in sales between 1939 and 1949. That is to say, in 1939 these companies were able to bring down to net income 15.1 cents out of each dollar of sales. Last year the figure was 11.2 cents. In common with most industries the chemical companies because of corporate income taxes require a larger volume of busines to produce the same net income as in prewar years. The trend in 1949 for the chemical companies, however, provides additional evidence of their inherent strength. Although the volume of sales was about the same in 1948 and 1949, net income last year was $50 million or 10% greater.

Total assets of the twenty-five chemical companies amounted to $3.4 billion at the end of 1949. This was approximately $2 billion or 135% above the figure of $1.4 billion at the end of 1939. It is significant to note that the increase in assets which reflects expansion plans now appears to be limited in the aggregate to the amount of retained earnings.

USE OF ASSETS IMPROVED

Last year the twenty-five companies reported sales equal to 99 cents per dollar of assets. This compared with $1.02 in 1948 and 64 cents in 1939. The better utilization of assets now compared to 1939 reflects the much more intensive use of facilities due to the strong demand. A slight decline in the sales to total asset ratio in 1949 compared to 1948 may be due in part to the tendency for companies to strengthen their working capital ratios.

It is interesting to note that the two companies showing the lowest ratio of sales to total asset—Dow and Mathieson—are also those that have undertaken extensive expansion of facilities and have experienced strong growth. Both of these companies reported a greater 1948 to 1949 sales increase than any of the twenty-five other companies.

In 1949 the twenty-five companies in the aggregate improved their working capital position. It appears that further strengthening of an already strong current position is underway. This is characteristic of the industry. Last year current assets increased by about $57 million, current liabilities declined by some $13 million and the current ratio improved from 3.5 to 1 in 1948 to 3.8 to 1 at the end of 1949. Working capital improved by $70 million over 1948, and was 116% greater than working capital at the end of 1939.

Net income reported by the twenty-five chemical companies in 1949 totaled $469 million, a new high. This was some 10% above the net of the previous year and 148% above the $189 million reported in 1939. As already pointed out, last year's net income rise is significant in light of the fact that sales remained practically unchanged. Figures for individual companies, however, show that thirteen out of the twenty-five reported declines from 1948 in net income and one company had a deficit during its 1949 fiscal year. The figures appear to indicate that as competition becomes keener and the leveling-off process

TWENTY-FIVE CHEMICAL COMPANIES—COMPARISON 1949, 1948 and 1939

(All figures in millions of $)	Year	Year End: Market Value of Equity	Year End: Total Assets	Year End: Current Assets	Year End: Current Liabilities	Year End: Working Capital	Year End: Par Value: Debt	Year End: Par Value: Preferred Stock	Sales	Net Operating Income	Net Income	Common Dividends
Air Reduction (1)	1939	146.1	38.7	20.0	3.4	16.6	.....	.....	27.6	6.0	5.1	3.7
	1948	51.7	89.2	42.6	11.9	30.7	29.5	.....	94.9	11.0	6.5	2.8
	1949	**62.6**	**90.6**	**44.2**	**11.1**	**33.1**	**28.5**	.....	**89.5**	**10.9**	**6.2**	**2.7**
Allied Chem. & Dye (1) (3)	1939	391.9	171.2	108.1	12.5	95.6	.....	.....	168.0	23.3	21.0	19.9
	1948	400.8	285.6	160.3	42.7	117.6	.....	.....	387.7	59.7	31.8	19.9
	1949	**453.9**	**301.4**	**161.0**	**42.0**	**119.0**	.....	.....	**363.7**	**60.8**	**37.2**	**22.1**
Amer. Agri. & Chem. (2)	1939	12.6	21.5	14.3	0.8	13.5	.....	.....	17.6	0.73	0.76	0.87
	1948	22.0	37.7	24.6	7.3	17.3	.....	.....	43.1	6.6	4.3	2.8
	1949	**27.8**	**38.4**	**24.5**	**5.2**	**19.3**	.....	.....	**46.5**	**6.3**	**4.2**	**2.8**
American Cyanamid	1939	89.0	72.3*	39.4	9.0	30.4	12.0	4.7	75.0	6.4	5.5	4.2
	1948	105.7	212.0	102.8	34.1	68.7	62.4	39.1	232.0	19.4	11.9	4.4
	1949	**142.0**	**224.1**	**112.4**	**39.3**	**73.1**	**57.5**	**36.8**	**237.7**	**28.5**	**16.1**	**6.2**
Atlas Powder (3)	1939	16.0	18.4	9.4	1.3	8.1	.....	6.9	16.5	1.5	1.3	0.75
	1948	15.5	29.0	16.5	3.1	13.4	3.0	6.8	43.1	1.9	1.3	0.65
	1949	**14.1**	**26.2**	**14.2**	**2.8**	**11.4**	.....	**6.8**	**34.6**	**2.3**	**1.6**	**0.65**
Commercial Solvents	1939	36.9	20.0	13.9	2.6	11.3	.....	.....	14.5	1.4	1.6	.....
	1948	43.8	39.9	17.1	3.9	13.2	.....	.....	41.5	7.7	5.5	3.9
	1949	**54.7**	**38.7**	**17.1**	**3.6**	**13.5**	.....	.....	**33.3**	**3.7**	**3.4**	**4.0**
Davison Chemical (2)	1939	3.6	11.7	6.1	0.3	5.8	1.4	.....	9.5	−0.27	−0.29	.....
	1948	9.8	25.2	12.3	2.1	10.2	4.7	.....	33.5	4.2	2.6	0.64
	1949	**11.6**	**26.6**	**12.6**	**2.5**	**10.1**	**4.2**	.....	**37.4**	**3.8**	**2.3**	**0.77**
Dow Chemical (4)	1939	148.6	41.9	14.3	2.7	11.6	5.7	6.0	26.8	3.8	4.2	3.0
	1948	240.4	271.5	83.2	29.1	54.1	68.2	70.4	170.7	34.9	21.1	5.0
	1949	**282.6**	**294.3**	**84.4**	**34.8**	**49.6**	**68.2**	**70.2**	**200.4**	**44.5**	**25.3**	**5.9**
Du Pont (1) (a)	1939	2,014.0	508.7	209.3	47.1	162.2	.....	169.0	298.8	67.3	93.2	77.4
	1948	2,057.6	857.2	406.8	87.1	319.7	.....	268.9	968.7	215.2	157.4	108.7
	1949	**2,762.9**	**920.7**	**449.9**	**88.3**	**361.6**	.....	**268.9**	**1,024.8**	**268.1**	**213.7**	**152.3**
Hercules Powder (5)	1939	117.2	42.5	21.7	3.0	18.7	.....	9.6	41.0	6.2	5.3	3.8
	1948	119.3	84.0	47.0	12.6	34.4	.....	9.6	129.3	17.8	10.9	5.9
	1949	**138.7**	**89.3**	**51.9**	**13.2**	**38.7**	.....	**9.6**	**121.0**	**16.4**	**10.0**	**6.9**
Heyden Chemical	1939	8.5	5.5	1.3	0.8	0.5	0.5	0.3	5.2	1.1	0.77	0.28
	1948	26.7	32.4	11.5	2.8	8.7	6.5	8.9	24.9	4.8	2.9	1.2
	1949	**21.9**	**31.6**	**11.3**	**2.1**	**9.2**	**7.2**	**8.8**	**26.2**	**2.6**	**1.5**	**1.3**
Hooker Electrochemical (6)	1939	2.1	7.4	2.4	0.6	1.8	2.6	2.7	5.7	0.62	0.4	0.1
	1948	23.3	27.4	13.2	1.8	11.4	3.0	10.0	23.7	4.3	2.9	0.97
	1949	**26.5**	**27.1**	**12.4**	**1.6**	**10.8**	**1.8**	**10.0**	**21.8**	**3.7**	**2.6**	**0.97**
Int'l. Min. & Chem. (2)	1939	0.9	26.7	6.5	0.4	6.1	3.3	10.0	11.7	0.16	0.13	.....
	1948	21.8	56.5	16.6	3.4	13.2	13.1	9.9	50.1	7.1	5.0	1.3
	1949	**27.1**	**59.9**	**18.8**	**3.3**	**15.5**	**13.0**	**9.9**	**53.4**	**7.9**	**5.4**	**1.5**
Mathieson Chemical	1939	24.8	24.9	4.5	0.8	3.7	.....	2.4	11.0	1.4	1.1	1.2
	1948	32.3	49.0	11.1	5.8	5.3	10.0	2.4	31.9	7.6	4.8	1.3
	1949	**63.4**	**81.5**	**24.4**	**7.9**	**16.5**	**20.0**	**2.4**	**54.1**	**11.4**	**7.0**	**2.6**
Monsanto Chemical	1939	135.3	54.8	20.8	6.0	14.8	.....	11.9	43.0	7.2	5.4	3.7
	1948	200.9	176.9	69.2	17.3	51.9	30.5	33.0	167.6	27.0	18.0	8.5
	1949	**241.1**	**180.4**	**73.1**	**13.2**	**59.9**	**30.4**	**33.0**	**165.9**	**28.4**	**17.2**	**8.6**
National Cylinder Gas	1939	12.2	6.9	1.7	0.4	1.3	.....	.....	4.9	0.86	1.0	0.47
	1948	15.4	27.1	8.6	3.6	5.0	4.7	3.1	25.9	2.9	2.7	1.1
	1949	**14.0**	**28.1**	**9.8**	**2.8**	**7.0**	**4.8**	**4.5**	**23.0**	**1.8**	**1.9**	**1.1**
Nopco Chemical	1939	7.9	4.7	3.1	0.9	2.2	1.2	.....	7.7	1.2	0.7	0.33
	1948	5.2	10.3	6.8	1.4	5.4	.....	2.4	20.1	1.4	0.59	0.35
	1949	**6.4**	**10.1**	**6.7**	**1.0**	**5.7**	.....	**2.4**	**16.9**	**1.4**	**0.63**	**0.35**
Newport Industries	1939	8.1	5.7	2.7	0.4	2.3	0.7	.....	4.6	0.5	0.4	.....
	1948	7.8	16.1	6.6	1.5	5.1	2.0	3.9	14.8	2.0	1.3	0.93
	1949	**8.2**	**15.7**	**6.3**	**1.0**	**5.3**	**1.9**	**3.8**	**13.6**	**0.59**	**0.4**	.....
Pennsylvania Salt (2)	1939	25.2	16.7	7.9	0.9	7.0	.....	.....	9.6	1.3	1.3	0.75
	1948	27.1	35.4	14.1	4.6	9.5	3.0	4.4	32.4	3.1	2.3	1.1
	1949	**34.2**	**38.9**	**15.8**	**4.6**	**11.2**	**5.5**	**4.3**	**33.2**	**3.9**	**2.7**	**1.4**
Pfizer, Chas. & Co.	1939	14.0E	.....	.....	.....	.....	.....	.....	6.2	1.1	0.87	0.73
	1948	67.3	48.4	31.4	11.1	20.3	.....	5.0	47.8	16.6	9.6	4.1
	1949	**82.5**	**51.3**	**31.6**	**10.2**	**21.4**	.....	**5.0**	**47.6**	**13.7**	**7.8**	**4.1**

TWENTY-FIVE CHEMICAL COMPANIES—COMPARISON 1949, 1948 AND 1939

(All figures in millions of $)	Year	Year End: Market Value of Equity	Total Assets	Current Assets	Current Liabilities	Working Capital	Par Value: Debt	Par Value: Preferred Stock	Sales	Net Operating Income	Net Income	Common Dividends
Rohm & Haas	1939	27.0E	.....	.....	.....	.....	.....	.....	14.0	2.3	1.8	.....
	1948	31.6	45.7	22.6	8.2	14.4	5.6	6.1	62.4	7.9	4.3	0.53
	1949	**53.2**	**45.6**	**22.8**	**6.9**	**15.9**	**2.2**	**6.2**	**62.4**	**8.3**	**5.1**	**0.77**
Union Carbide & Carbon	1939	807.2	336.8	133.4	22.6	110.8	40.0	.....	170.3	42.9	35.8	18.3
	1948	1,184.7	722.7	356.0	125.0	231.0	150.0	.....	631.6	155.2	102.3	52.7
	1949	**1,285.5**	**744.3**	**335.6**	**111.6**	**224.0**	**150.0**	.....	**585.8**	**140.5**	**92.2**	**57.6**
U. S. Industrial Chem. (7)	1939	9.0	13.9	9.8	2.3	7.5	.....	.....	11.9	0.10	0.08	.....
	1948	10.0	46.7	27.3	6.5	20.8	7.5	.....	73.3	2.3	2.6	1.2
	1949	**11.7**	**41.7**	**20.5**	**4.7**	**15.8**	**7.3**	.....	**50.8**	**0.81**	**−2.4**	**0.5**
Victor Chemical Works	1939	20.8	8.7	3.6	0.8	2.8	0.9	.....	8.4	1.3	1.1	0.97
	1948	27.2	22.3	9.3	2.0	7.3	0.3	8.0	25.8	3.5	2.2	1.3
	1949	**35.1**	**25.5**	**11.4**	**2.0**	**9.4**	**0.2**	**9.6**	**29.4**	**4.9**	**2.9**	**1.5**
Virginia-Carolina Chemical (2)	1939	1.9	25.5	10.8	1.6	9.2	.....	21.3	16.8	0.43	0.51	.....
	1948	4.1	44.4	23.8	5.6	18.2	4.1	21.3	53.4	8.1	5.0	.....
	1949	**3.6**	**47.2**	**25.4**	**5.5**	**19.9**	**5.5**	**21.3**	**58.7**	**6.8**	**4.1**	.....

(1) Certain outside investments of these three companies are excluded from total assets in the amounts shown below. Also shown is other income which is not excluded from net income.

		Certain Outside Investments Million $	Other Income Thousand $
Air Reduction	1939	$5.5	$193
	1948	5.2	700
	1949	5.6	500
Allied Chemical	1939	44.2	2,051
	1948	31.8	4,090
	1949	31.6	3,800
Du Pont (Gen. Motors Investment)	1939	197.0	35,000
	1948	291.5	45,000
	1949	343.5	80,000

(2) Year or year ended June 30. Pennsylvania Salt year ended June 30 applies only in 1939.
(3) Goodwill excluded from total assets $4.1 million for Atlas Powder and $21.3 million for Allied Chemical.
(4) Year or year ended May 31.
(5) Goodwill amounting to $5.0 million excluded from total assets in 1939.
(6) Goodwill amounting to $2.5 million excluded from total assets in 1939.
(7) In 1949 and 1948, data are for year ended March 31, except value of equity.
* $5.0 million patents etc. excluded from total assets.
(a) Goodwill patents, trademarks excluded from total assets: 1939 $30.1 million; 1948 40.6 million; 1949 40.4 million

progresses, the differences in relative performance between companies become more marked.

Operating profit of the chemical companies in 1949 continue the steady improvement evidenced in the postwar years. These companies had an aggregate net operating profit of $682 million last year which compared with $632 million in 1948 and $178 million in 1939. The comparison with 1939 is interesting, first because the ratio of net operating income to sales was 17.4% in that year against 19.8% last year and, second, because the 1949 net operating income was 281% above the 1939 figure in contrast to a 234% increase in sales between the two years. In earning power, the industry as revealed by this sample group of twenty-five chemical companies is stronger than in the prewar year of 1939!

Last year there was an increase in net worth of approximately $250 million above the $2.6 billion aggregate net worth of the twenty-five companies in 1948. Since debt and preferred remained unchanged, the increase during 1949 was almost entirely due to the ploughing back of earnings. From 1939 to 1949 these companies nearly

TWENTY-FIVE CHEMICAL COMPANIES—1949 COMPARISONS EARNING POWER, FINANCIAL POSITION, TREND IN VOLUME OF SALES

	Earning Power — 1949: Net Income to Sales	Earning Power — 1949: Net Income to Net Worth	Sales to Total Assets	Current Assets to Current Liabilities 12/31/49	Sales % Increase: 1939–1949	Sales % Increase: 1948–1949
Air Reduction	6.4%*	11.4%	99%	4.0 to 1	224%	− 6%
Allied Chem. & Dye	9.4**	12.9	121	3.8	116	− 6
Amer. Agri. Chemical	9.0	13.3	121	4.7	164	+ 8
American Cyanamid	6.8	13.0	106	2.9	216	+ 2
Atlas Powder	4.6	7.3	132	5.1	110	−20
Commercial Solvents	10.2	10.2	86	4.7	130	−20
Davison Chemical	10.2	19.0	141	5.0	294	+12
Dow Chemical	12.6	13.3	68	2.4	648	+18
Du Pont	13.1***	19.9	111	5.1	241	+ 5
Hercules Powder	8.3	15.7	136	3.9	195	− 6
Heyden Chemical	5.7	6.8	83	5.4	404	+ 5
Hooker Electrochemical	11.9	11.0	81	7.7	282	− 8
Int'l. Minerals & Chemical	10.1	12.4	89	5.7	356	+ 7
Mathieson Chemical	12.9	13.6	66	3.1	391	+69
Monsanto Chemical	10.4	13.6	92	5.5	285	− 1
Nat'l. Cylinder Gas	8.3	9.4	82	3.5	368	−11
Nopco Chemical	3.7	6.8	167	6.7	120	−16
Newport Industries	2.9	3.3	87	6.3	196	− 8
Pennsylvania Salt	8.1	9.8	85	3.4	246	+ 2
Pfizer, Chas. & Co	16.4	19.9	93	3.1	666	− 1
Rohm & Haas	8.2	14.0	137	3.3	346	0
Union Carbide & Carbon	15.7	19.4	79	3.0	244	− 7
U. S. Industrial Chemicals	def.	def.	122	4.4	326	−31
Victor Chemical Works	9.9	13.3	115	5.7	250	+14
Virginia-Carolina Chemical	6.9	11.4	126	4.6	249	+10
Average	11.2	16.3	99	3.8	234	0

* $500,000 other income excluded from net income.
** $3,800,000 other income excluded from net income.
*** $80,000,000 other income excluded from net income.

doubled their net worth (95% increase). Earnings on net worth were 16.3% last year, a new high. This compared to 15.6% in 1948 and 12.8% in 1939. The amount of "senior" money (debt and preferred stock) in these twenty-five companies was close to $600 million larger than in 1939.

OWNERS FARED BETTER

Common dividend payments in 1949 aggregated $286 million compared to $231 million the year previous and $140 million in 1939. The increase in dividend disbursements during this period was 104% which compares with an increase in net income in 1949 over 1939 of 148%. Thus, the "payout" is still less than it was in 1939. It was 74% in that year and 61% last year. There was, however, a material improvement in the amount distributed last year compared to the 55% paid out in 1948. There is less urgent need for capital funds as expansion and rehabilitation programs taper off.

As was emphasized at the beginning of this article the most striking change in the figures of the twenty-five companies was the increase of $1.1 *billion* in market value of their equities during 1949. This change in the face of no change in aggregate sales and a $50 million increase in net income reflects a considerable improvement in sentiment toward earnings and prospects of these companies. The market value of twenty-one out of the twenty-five companies were higher at the end of 1949 than at the end of 1948. Since thirteen out of the twenty-five reported declines in net income it is evident that investors were disposed to value these stocks at a higher price regardless of the apparent change in earnings.

'50 OFF TO FLYING START

At press time first quarter reports from the following companies indicate that the industry is on its way to another good year.

	First Quarter Sales		First Quarter Earnings	
	1950	1949	1950	1949
	($000)		($000)	
Air Reduction	22,052	23,632	1,847	1,817
Atlas Powder	8,366	8,435	400	338
Comm'l Solvents	...	...	675	861
Davison (9 mos. to 3/26)	23,640	25,725	1,115	1,462
Diamond Alkali	12,700	12,480	1,055	806
Dow (9 mos. to 2/28)	154,721	149,665	22,681	21,393
Du Pont	267,000	249,484		
Interchemical	18,500	17,910	900	472
Hercules	32,995	30,168	2,794	2,501
Heyden Chemical	6,571	7,286	419	565
Koppers	53,969	49,126	1,794	1,617
Mathieson	17,901	...	2,202	1,291
Monsanto	49,183	40,893	5,847	4,461
Penn Salt	...	...	941	589
Rohm & Haas	18,143	14,506	1,702	902
Tex. Gulf Sulph.	15,798	14,954	6,407	6,332
Union Carbide	159,696	157,037	27,407	24,529
Va.-Carolina	...	...	1,341	1,988
Victor Chemical	...	...	1,013	500

Thus, in the case of Monsanto Chemical the 1948 and 1949 figures for sales and earnings were approximately the same, but the value of its common stock was $40 million higher at the end of 1949. Union Carbide and Carbon in 1949 reported a reduction in sales of 7%, and a decline of $10 million (10%) in net income. Its common stock had a value in the market at the end of 1949 which was $100 million greater than at the end of 1948.

These figures demonstrate with some force the growing conviction that sound going concerns were being undervalued in the market by timid investors. The earnings of the twenty-five companies in 1949 were being capitalized at the end of the year at a ratio of 13 to 1. This compared to a ratio of 12 to 1 in 1948 and 23 to 1 in 1939. The approximate yields were 3.5% and 4.9% in 1939 and 1949 respectively.

AND THE FUTURE?

These financial statistics look good. But the forces from which the prosperity derives its strength are difficult to assess with any reasonable degree of certainty or conviction. There is and should be a distrust in the means and methods used by the government authorities to sustain business activity. Some of these are in the nature of artificial stimulants, some are unsound economics, while others are wasteful practices which ultimately must cease.

The continued high rate of capital expenditures at about the $16 billion level and a sustained demand experienced by the automobile and steel industries are strong supports to the high level of production. Total federal budget expenditures are at a rate of $43 billion annually and receipts are estimated at about $37 billion. The excess of expenditures over receipts amounting to some $6 billion dollars during a period of boom is fundamentally wrong. A searching question must be, when and where does it stop? The agricultural price support program, the volume of consumer credit and expenditures in connection with the European Recovery Program are some of the props supporting business activity. These factors have at least in part been responsible for the undercurrent of uncertainty or doubt that seems to prevail. The chemical companies, off to a good start in 1950, appear to be headed for another record year, however.

Mixed Construction Activities Affect

EXPANSION AND RESEARCH

by J. H. SPRAGUE, JR.* and H. W. YEAGLEY*

PLANT CONSTRUCTION dropped from 1948 for most producers, but laboratory facilities continued to expand. Expansion plans for 1950 vary.

THE FIRST postwar decline in chemical sales coupled with completion of major expansion programs resulted in a general reduction in capital expenditures in 1949. The level of research activities varied little from the year before, but expansion of laboratory facilities continued at a rapid rate.

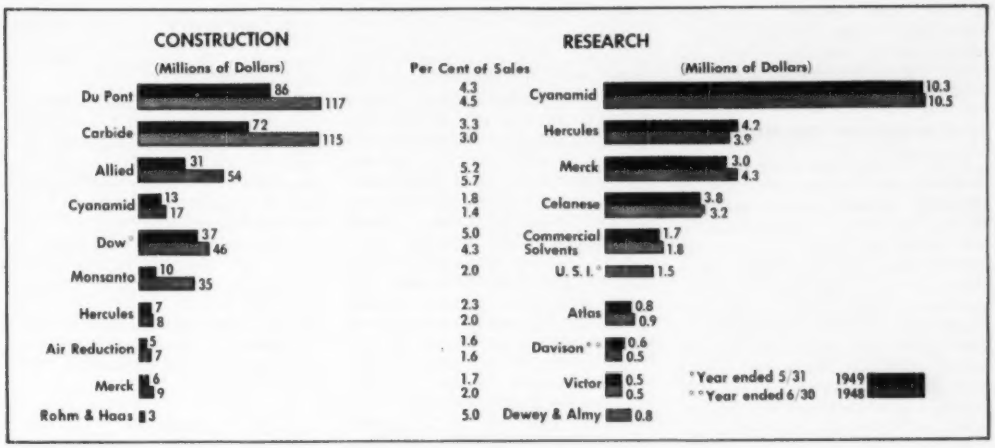
Nineteen hundred and forty-nine capital expenditures are shown in the accompanying chart for companies with sales over $60 million and in the table on page 677 for companies in the $20-$60 million range. It will be noted that in both groups reductions were for the most part on the order of 30-40%, with some as high as 70-75%.

There were two exceptions to the general trend: (1) Mathieson with an expansion of $30 million resulting in part from its acquisition of Standard Wholesale Phosphate and Acid Works, Inc., and Southern Acid and Sulfur and in part from new facilities, and (2) Davison with a slight increase over 1948.

Less than average declines were reported by Du Pont, Cyanamid, Dow, Hercules and Pfizer. American Agricultural Chemical showed no change.

Concerning 1950 expansion programs, the outlook is mixed, but definite increases are currently planned by a number of companies. Rohm & Haas expects to nearly triple its 1949

* Monsanto Chemical Co., Washington, D. C.



spending with a $7 million program. USI foresaw expenditures of $4 million for the fiscal year ended in 1950 vs. $3.1 million in its last fiscal year.

Others planning increases are Hooker with substantially higher outlays principally at Tacoma, and Hercules with somewhat higher expenditures including its Oregon pilot plant. Pfizer sees construction at approximately the same rate. Merck reports $3.3 million remaining from last year's authorizations. Union Carbide is one of the firms anticipating somewhat lower spending. Penn Salt reports its postwar expansion program substantially completed. Harshaw discontinued all construction except its glycerine plant. International Minerals reported no major construction presently in progress. Celanese and Koppers also plan no major expansion.

RESEARCH

An examination of research expenditure figures indicates that for the most part these varied little from 1948. Hercules, Davison and Victor showed slight increases and Cyanamid, Merck, Celanese, Commercial Solvents, and Atlas showed slight decreases. One notable exception was Pfizer, which while quoting no figures stated that research expenditures had been more than doubled. Also giving no figures but reporting the largest spending in company history were Hooker and Penn Salt, the latter also forecasting a gradual increase for 1950.

Of the 16 reported additions or expansions, many indicated a definite trend toward centralized research facilities for added efficiency. Du Pont's enlarged Experimental Station near Wilmington reached 70% completion and will eventually house half of its research staff. All USI research and development activities were consolidated in the Baltimore area except the Newark resin technical lab and Dodge & Olcott's Bayonne, N. J., lab; suitable existing buildings were reconditioned and equipped. Air Reduction sold its Stamford, Conn., liquefaction research building at a loss of $300,000 to realize economies from consolidation at Murray Hill, N. J. Schenley purchased a research center near Stamford, and design work on International Mineral's new central laboratory near Chicago is proceeding. Shell Development's Emeryville laboratories are being expanded to permit further centralization.

Other expansions indicating a future research uptrend were reported by a wide range of companies including several in the pharmaceutical field. Merck reported a pilot plant addition and completion of another laboratory building for the Merck Institute of Therapeutic Research. Pfizer completed a new engineering and process building in Brooklyn and expanded facilities for chemical and biological research, pharmacology, and product evaluation. Commercial Solvents Co.'s research additions finished in 1949 cost $1.6 million. Pittsburgh Coke completed a new research laboratory, and Monsanto a new laboratory at Texas City. A new metal soaps and pigment laboratory was finished by Harshaw. Hooker is constructing a large pilot plant at Niagara Falls. Shell organized a small group at Houston to concentrate on product and process improvement. Other oil company expansions were made by Lion Oil and California Research Corp. (Standard of California).

A comparison of research emphasis sometimes affords a reflection of corporate policies. An interesting contrast was presented this year in the fertilizer field, International Minerals reporting emphasis shifting to diversification and Davison reporting emphasis on existing basic products and process improvement.

DISTRIBUTION

The definite increase in competition resulted in major expenditures for better customer service, better distribution facilities, and lower cost methods of transportation.

To serve eastern markets better Shell transferred a major portion of its technical service activities from Martinez, Calif., to a new lab at Union N. J. Atlas expanded its industrial finishes customer service departments at Stamford and North Chicago.

To provide better distribution USI is expanding storage, handling and packaging facilities at Chicago, and Harshaw has leased new warehouses in Cleveland, Chicago and Houston. A St. Louis branch office and warehouse has been established by Merck. Penn Salt has completed an anhydrous ammonia cylinder filling unit at Cornwells Heights, Pa., and an acetic acid distribution center has been established by Celanese at Rock Hill, S. C. Victor's purchase of A. R. Maas Chemical Co. of Los Angeles was probably made in part to strengthen Victor's competitive position in the western market.

Attempts to achieve lower costs through water transportation were made by Celanese which completed facilities for tanker shipments of formaldehyde to the East Coast, by Commercial Solvents which began barge shipments of methanol from Sterlington, La., by Dow which chartered the S.S. Marine Chemist and by Monsanto which reported water movements of styrene.

Although spectacular expansions such as those of Shell and Koppers

in 1948 were missing, competition from firms in other industries, especially in the oil, coal, liquor, glass and rubber industries continued to grow in 1949.

INTER-INDUSTRY COMPETITION

Lion Oil was one of the most active companies making large expansions in ammonia, sulfuric acid, ammonium sulfate, ammonium nitrate finishing and asphalt specialties. Lion research covered selective weed killing oils, a sugarcane defoliating agent and new fertilizers, agricultural solvents, and insecticides. Phillips Petroleum, another active firm, reported large ammonia, ammonium nitrate and ammonium sulfate expansions, with research emphasis on rubber modifiers and accelerators, isohexanes for vegetable oil extraction, and olefin-sulfur dioxide polymerization. Other oil company activities include Standard's (Calif.) purchase of the remaining minority holding in California Spray Chemical and its synthetic fuel research, and Shell's new acetone and agricultural products facilities.

Much of Pittsburgh Coke and Chemical's expansion was in agricultural chemicals with a parathion plant installed, a benzene hexachloride plant nearing completion, 2, 4-D facilities expanded, and formulating facilities increased. Raw materials were increased by a new 35 unit coke oven battery (50% increase). Protective coating capacity was doubled, and a blast furnace flue dust briquetting plant completed. There were no major Koppers expansions, but research developed new polystyrene, lower resorcinol costs and a new organic intermediates line.

Schenley pharmaceutical activities should increase from its information exchange agreement with Bayer Pharmaceutical Labs at Leverkusen and Elberfeld, whereby Schenley receives a U. S. license to produce any Bayer discovery. Tibione, a new tuberculosis drug, is currently being distributed clinically under the agreement. Schenley research was resumed on animal protein factor, although it continues primarily on antibiotics. National Distillers began construction of its $10 million metallic sodium and chlorine plant at Ashtabula, Ohio.

Pittsburgh Plate Glass completed a chlorinated benzene and related products plant and a 25% chlorine expansion at Natrium, W. Va. Intensive research on insecticides and herbicides may lead to production this year. Other research was largely in the coatings resins, plastics, and brush fields. Libbey-Owens-Ford introduced new alkyds, an aminoplast wet strength paper resin, and silanes, as well as glues, molding compounds, and coating resins.

Rubber company competition increased with U. S. Rubber purchasing Glenn L. Martin's Chemical Division including the country's third largest vinyl plant, Firestone increasing Velon film and filament capacity, Goodyear introducing a new vinyl flooring and a wide range of colored vinyl film, and Goodrich completing a new chemicals plant at Avon Lake, Ohio.

New Celanese chemicals included propylene glycol, isobutyl alcohol, and several industrial proprietary solvents. Study is progressing on non-cellulosic fibers with an attempt to use raw materials produceable at its Bishop plant.

There were two instances of lessening competition this year: Sherwin-Williams' disbanding of its agricultural chemicals department and Glenn L. Martin's sale of its plastic interests. Two chemical companies discontinued non-chemical activities: Commercial Solvents sold its 50% interest in Commercial Molasses and Harshaw discontinued manufacture of antimony metal and antimony oxide.

AGRICULTURAL CHEMICALS

Agricultural chemicals were again one of the most rapidly expanding fields with greatly increased activities in fertilizers, insecticides, herbicides and feed supplements.

The principal fertilizer expansions were in ammonia and its derivatives: *Ammonia*—Lion Oil, Phillips Petroleum, Hercules; *Ammonium Nitrate*—Lion Oil, Phillips, Allied; *Ammonium Sulfate*—Lion Oil, Phillips, Hercules, Mathieson.

Phosphate mining facilites were expanded by International Minerals and Davison; superphosphate facilities by Davison and Mathieson. Fertilizer research was mentioned by Lion Oil and International Minerals. International and Mathieson reported the development of new high analysis fertiliers.

Most leading insecticides and herbicides saw expansion or further development. A 2,4-D plant was completed by Dow, and Pittsburgh Coke's facilities were expanded. Hooker, sole producer of lindane, reported further development; a $450,000 lindane plant has been authorized by Commercial Solvents. Pittsburgh Coke's benzene hexachloride plant is nearing completion and a parathion plant has been installed. Other developments include a Hooker sodium trichloroacetate plant under construction, a Hercules 50% toxaphene expansion, and new Dow facilities at Seal Beach, Calif. Research activities include extensive field tests on Dilan, nitroparaffin derivative, by Commercial Solvents; and selective weed killing oil and sugarcane defoliating oil research by Lion. Research was also reported by Allied, Monsanto, USI, Pittsburgh Plate and Shell.

In the new and growing field of feed supplements, animal protein factor was mentioned frequently with expanded facilities by Pfizer, equipment expenditures by Merck, and resumption of research by Schenley. Commercial Solvents completed a $2 million vitamin feed supplement plant and introduced a new dry form of choline supplement. International Minerals has a new phosphate supplement ready for large-scale pilot plant and is studying trimethyl glycine. Dow is constructing a methionine plant at Pittsburg, California.

PLASTICS

New developments included molding compounds, films and specialty resins. Koppers improved the clarity of its high temperature polystyrene and developed three related polymers. G. E. has incorporated a rubber component to produce a shock-resistant phenolic. Additional urea molding compounds were developed by Libbey-Owens-Ford. Phillips Petroleum is studying catalysts and the emulsion polymerization of low cost olefins with sulfur dioxide. A new proces for superior acetate film at lower costs has been developed by Celanese and a plant addition is planned. Monsanto introduced vinyl chloride resins and film and increased polystyrene production.

In the specialty field Dow added facilities for ion exchange resins and Rohm and Haas expanded its ion exchange resin line. Coating resins research was reported by Pittsburgh Plate and Libbey-Owens-Ford. An aminoplast wet strength paper resin was introduced by Libbey-Owens-Ford as well as new alkyds for electrical equipment. Additional flame resistant acetate formulations were developed by Celanese, and research on synthetic resins reported by USI. Libbey-Owens-Ford began production of silanes, silicone raw materials; silicones commanded major attention from G. E.

SYNTHETIC FIBERS

Non-cellulosic synthetic fibers showed signs of becoming a rapidly growing field. Du Pont expanded nylon products facilities and began construction of an Orlon plant. Dow completed a 5 million lb./month vinyl-vinylidene chloride (Saran raw material) plant as well as added facilities for Saran itself. Union Carbide announced its entry into the field with a new fiber, Dynel. Monsanto and American Viscose formed Chemstrand, a joint subsidiary, for the develop-

1948-1949 CONSTRUCTION COMPARISONS

(Companies with sales under $60 million)

Sales			Construction	
		(Millions of Dollars)		
1948	*1949*		*1948*	*1949*
31.9	54.1	Mathieson	15.8	30.2
50.1	53.4	International Minerals*	9.3	3.7
73.3	50.8	USI****	5.3	3.1
47.8	47.6	Pfizer	5.1	4.6
43.1	46.5	American Agricultural*	1.9	1.9
33.5	37.4	Davison*	2.1	2.4
43.1	34.6	Atlas Powder	1.9	1.1
36.0	34.1	Harshaw**	2.0	0.5
41.5	33.3	Commercial Solvents	5.0	1.5
32.4	33.2	Penn Salt	7.5	4.0
25.8	29.4	Victor	3.4	2.2
23.7	21.8	Hooker***	3.3	2.0

* *Year ended June 30*
** *Year ended September 30*
*** *Year ended November 30*
**** *Year ended March 31*

ment of synthetic fibers. Celanese is studying the production of synthetic fibers from petro-chemical sources.

PHARMACEUTICALS

Chemical companies continued their expansion in the antibiotics field. A $670,000 antibiotics expansion was authorized by Commercial Solvents; antibiotic finishing and packaging facilities were added by Merck; and added antibiotic fermentation facilities installed by Pfizer. Schenley research continues primarily in antibiotics. With regard to specific antibiotics, Cyanamid expanded aureomycin production and Pfizer is introducing terramycin commercially in 1950.

Synthetic Vitamin A was an important new development, pilot plant production being started by Pfizer and equipment expenditures made by Merck. Other important developments include Merck's production of cortisone, Pfizer's new plant for synthetic caffeine and theophylline, Monsanto's production of para amino salicylic acid, N'benzoyl sulfanilamide and several anti-histaminics, and Socony-Vacuum's expanded production of thiophene for anti-histaminics.

ORGANIC CHEMICALS

Expansion in the basic organics continued. Methanol expansions were reported by Du Pont and Allied; phenol expansions completed by Dow and begun by Union Carbide. A formaldehyde addition was also completed by Allied. USI was active constructing its water-soluble chemicals plant to be operated in conjunction with Standard's Brownsville hydrocarbon synthesis operation.

In the halogenated organic field Pittsburgh Plate completed a chlorinated benzene and related products plant and expects initial production of other chlorinated products this year; Hooker-Detrex is constructing a chlorination plant at Ashtabula, Ohio; and Penn Salt reports an important chlorinated organic compound in the field evaluation stage. Penn Salt is field testing several organic fluorine compounds.

Other expansions include Celanese's new propylene glycol, isobutyl alcohol, and proprietary solvent facilities, Shell's new Houston acetone facilities, Harshaw's glycerine plant construction, Hercules' rosin amine unit, and Merck's new miscellaneous organics building.

Research developments include a new hydrazine process by Mathieson, trimethyl glycine studies by International Minerals, and intensive isobutanol research by Commercial Solvents who also report amines in pilot plant production. Air Reduction is investigating carbide processes in anticipation of an expanding acetylene chemical industry.

INORGANIC CHEMICALS

Chlorine again led inorganic chemicals in expansions. Included were Dow's 30% West Coast chlorine-caustic expansion, its Canadian chlorine-caustic expansion, Pittsburgh Plate's 25% increase at Natrium, W. Va., Penn Salt's chlorine-sodium chlorate expansion at Portland, Ore., and National Distiller's $10 million Ashtabula, Ohio, metallic sodium-chlorine plant now under construction.

New sulfuric acid plants were completed by Lion Oil, Mathieson at Pasadena, Texas, and Baltimore, Monsanto (a replacement) near Boston, and Penn Salt at Calvert City, Ky. Penn Salt also completed its new Calvert City HF and related products plant; a fluoride salts addition has been authorized and inorganic fluorines are in the field evaluation stage.

Other inorganic expansions include International Mineral's refined potassium chloride and potassium sulfate addition, and Air Reduction's 50 ton/day dry ice plant. USI is also planning a dry ice expansion in 1950. Mathieson developed new processes for sodium nitrate and sodium chlorite.

SPECIALTIES

Detergents again increased in volume. Allied completed new facilities and Penn Salt an alkaline detergents capacity increase. Hercules will produce rosin base emulsifiers and detergents in 1950. In other fields facilities were expanded for plasticizers and paint anti-skinning agents by Allied, titanium pigments by Du Pont, carboxy-methylcellulose by Hercules, silica gel catalysts by Davison, mono sodium glutamate by International Minerals and adhesives by Monsanto.

Research was reported by Pittsburgh Plate on Hi-Sil silica pigments, by Phillips on rubber modifiers, rubber accelerators and isohexane for vegetable oil extraction, by Monsanto on food additives and detergents, oil additives, bulb frosting coatings and paper coatings, by Lion Oil on asphalt specialties, and by Hercules on cellulose derivatives, coated paper adhesives, and wet strength paper chemicals. New Commercial Solvents plasticizers and emulsifiers are in pilot plant production; Commercial also introduced three automotive consumer specialties.

Detailed summaries for individual firms follow:

AIR REDUCTION CO., INC.

Sales: $89.5 million.
Expansion: $4.6 million.
Facilities Expanded Chicago "Dry-Ice" from coke plant being expanded 50 tons per day.
Research: Stamford, Conn. liquefaction research building sold at loss of $306,000 to permit research consolidation at Murray Hill, N. J. Emphasis on liquid oxygen production and calcium carbide production, latter because of expanding chemical uses for acetylene. New aerosol unit for automatic administration of penicillin and streptomycin introduced by Ohio Chemical and Surgical Equipment Div.

ALLIED CHEMICAL AND DYE CORP.

Net Sales: $364 million.
Expansion: $30.5 million.
Facilities Expanded: Methanol, formaldehyde, anti-skinning agents for paints, new ammonium nitrate-ammonia solution for fertilizer use, new detergents and dyestuffs. Additional new products include plasticizers, insecticides, weed killers, high grade dyes, and urea. Roughly half of expenditures were for replacements.

AMERICAN CYANAMID CO.

Net Sales: $238 million.
Expansion: $13.1 million.
Facilities Expanded: Aureomycin.
Research: $10.3 million.

ATLAS POWDER CO.

Sales: $34.6 million.
Expansion: $1.1 million.
Facilities Expanded: Industrial Finishes Department's customer services facilities expanded at Stamford and North Chicago. Laundry roll cover operations relocated at Stamford for increased efficiency.
Research: $764,000. Current research facilities represent $1.32 million investment. New types of detonators and blasting caps introduced.

CELANESE CORP OF AMERICA

Sales: $171 million.
Expansion: $7.9 million.
Facilities Expanded: New chemicals brought into production: Propylene glycol, isobutyl alcohol, and several industrial proprietary solvents. Large paraformaldehyde pilot plant completed. Full operation of formaldehyde tanker shipments from Texas to East Coast achieved. Acetic acid distribution center established at Celriver plant, Rock Hill, S. C. All Chemical Depts. brought into operation in 1949. Good progress on high alpha cellulose plant near Prince Rupert, B. C.
1950 Plans: No future large U. S. expansion authorized, but plans for future expansions being considered. Additional acetate film facilities scheduled for installation in 1950. Capacities of Cellulose Mexicana, S. A. and Viscosa Mexicana S. A. to be increased again in 1950.
Research: $3.0 million. New flame-resistant acetate formulations developed. Study progressing on non-cellulosic fibers with attempt to utilize materials that can be produced in Bishop Texas plant. Spinning and dyeing improvements realized. New process for making superior packaging materials at lower cost reached the initial production stage. Chemical application research and wood pulp purification research continued.

COMMERCIAL SOLVENTS CORP.

Net Sales: $33.3 million.
Expansion: $1.5 million.
Facilities Expanded: $2 million vitamin feed supplement plant completed at Peoria. Barge shipment of methanol begun from Sterlington, La. $670,000 antibiotics expansion and $454,000 lindane expansion authorized. Benzene hexachloride expansion necessary. 50% interest in Commercial Molasses sold to that firm.
Research: 5% of sales. Additions to buildings and equipment completed in 1949 cost $1.6 million. New dry form of choline feed supplement introduced. Extensive field tests on Dilan, nitroparaffin insecticide. Intensive research on butanol production. New pharmaceuticals introduced. Under Medical Department supervision 60 chemical studies on products were conducted at 31 hospitals and university clinics. New automotive consumer specialties included Car Wash, Penetrating Oil, and Windshield Washer Fluid, five

(Turn to page 787)

Statistical design of experiments allows study of many variables simultaneously.

Applied Mathematics Saves Research Time and Materials

by W. L. GORE, Polychemicals Department
E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

THE SAME MATHEMATICAL LAWS of statistics and probability that make for winning poker can reduce the number of experiments and still give more dependable research data.

THE MOST potent argument for the use of statistically designed experiments is the saving in time and material which may be obtained by reducing the number of observations to yield a given amount of information. This gain may vary from only a small fraction with simple experiments to many-fold in cases where months are lost with conventional methods in unraveling the complex interrelationships of multivariate processes. In a fair number of situations the required information can be obtained only by the application of statistical experimental methods.

Chemists and engineers often have what may be an unwarranted confidence in their ability to design sound and efficient experiments. This confidence arises from their conviction that they have logically analyzed the factors involved in a particular problem, and therefore the proposed experiments will unfold to quantify and corroborate the analysis.

While it is agreed that the knowledge, skill, common sense, and material resources of the experimenter are indispensable ingredients in the success of the experimental program, a truly efficient experiment will include an evaluation of several alternative hypotheses, and a truly sound experiment will give a valid estimate of the experimental errors. The science of statistical designs of experiments is concerned with the efficiency of arranging the factors of an experiment and the validity of error estimates.

In most places where statistical experimentation is brought to bear for the first time, the number of observations is increased rather than decreased. This results from the discovery that the conventional experimental procedures have been less precise and reliable than was supposed, and therefore statistical experiments have been executed to obtain more information than was previously considered satisfactory.

Although a great deal of attention has been given in the past few decades to problems of designing experiments in biology and agronomy, little has been done in the engineering and chemical fields. It appears that the principles are identical in all fields of application, the primary differences being in the relative usefulness of different techniques.

Because the problems of the chemical industries are peculiar to chemical mechanisms, it appears important for the investigator designing experiments to be aware of the chemical aspects of the problem. This leads to the necessity for chemists to become proficient in statistical methods or for statisticians to become chemists, also. Fortunately, chemists can easily acquire a sufficient knowledge of these new concepts to make effective use of them, and only require consultation with a trained statistician for the more complex and obscure applications.

The mathematical bases of these principles are somewhat rigorous, and the arithmetical treatments of data are often complex and usually tedious. It is therefore proposed to outline some of the concepts and principles of statistical design in a very general way without going into either the mathematical bases or the arithmetical methods of analysis for the examples cited. The chemist or engineer who wishes to use these methods must delve deeper into statistical texts such as are listed in the bibliography.

STATISTICAL CONCEPTS

At the conclusion of any experiment a decision is required as to whether each factor has shown an effect, and an estimate made (with minimum and maximum limits) of the magnitude of the effect. This decision involves the probability that the observed effect could arise as a consequence of chance fluctuations in experimental errors.

Unless there is very little likelihood that chance fluctuations could produce an effect as great as that observed, a decision is not justified that the factor has a real effect. This calculation of probability of experimental errors producing an effect as large as that observed is called a *test of significance* and all statistically designed experiments must be arranged so that such probabilities can be computed.

The traditional concept of controlled experimentation requires that differences be observed between a control condition, sample, etc., and an experimental set. The new statistical designs are more general and require a recognition of all independent differences between the observations of an experiment. These independent differences are called *degrees of freedom*. Prior to deciding on an experimental design, all degrees of freedom are tab-

ulated to study the information which one may expect to gain.

For a simple example, the proposed experiment to evaluate the effect on rate of changing a reaction temperature from T_1 to T_2, running duplicate tests at each temperature, would be analyzed as follows:

Source of Variation	*Degrees of Freedom*
Temperature change	1 (the 1 independent difference between 2 temperatures)
Error	2 (the sum of the 1 independent difference between each of the 2 sets of duplicates)
Total	3

In general there is one less degree of freedom than the total number of observations (there is but one independent difference between two measurements, two between three measurements, etc.).

This would not be a sound design if duplicate tests were not run at each temperature, because no degrees of freedom would be available for estimating the experimental errors; hence no judgment (from the experimental data) could be made as to whether temperature affected the reaction rate. More than two temperature levels and more than two tests at each level might be investigated with a consequent increase in the range and precision of the information obtained.

FACTORIAL DESIGN

The factorial design is the simplest and perhaps most useful of statistical designs. The requirement for a factorial design is that each level of each factor must be combined in one of the experimental batches with each level of every other factor to be tested. For example, one may be interested in the effect of temperature and pressure on the density of a material. The four experimental combinations making up a factorial arrangement of two levels of temperature, T_1 and T_2, and two levels of pressure, P_1 and P_2, are:

$T_1 P_1$	$T_1 P_2$
$T_2 P_1$	$T_2 P_2$

The three degrees of freedom for the four experimental batches are assigned:

Source of Variation	*Degrees of Freedom*
Pressure	1
Temperature	1
Interaction of pressure and temperature	1
Total	3

The interaction degree of freedom is used to give a measure of the preferential response with combinations of factors. This interaction effect will be significant whenever the observed measurements are nonlinear functions.

Because most of the relationships in chemical mechanisms are curvilinear, it is particularly important to evaluate the interaction effects when dealing with chemical phenomena.

No estimate of experimental error is available from the above experiment, and therefore it will not contain within the data the necessary information to judge whether the differences observed are chance fluctuations or real effects of temperature, pressure, and interaction of pressure-temperature. If duplicate observations are made on each of the experimental combinations, four additional degrees of freedom will be available to estimate the experimental error, and the design can then be considered statistically sound.

Some of the properties of a factorial experiment can be illustrated by considering the numerical example in Table I.

TABLE I—DENSITY OF AIR (gm./l.)

	1 atm. press.	*2 atm. press.*	*Ave.*
	(a)	(b)	
Temp.	1.7651	3.5290	
200°A	1.7645	3.5297	2.6471
	(c)	(d)	
Temp.	1.1769	2.3525	
300°A	1.1765	2.3535	1.7648
Ave.	1.4707	2.9412	2.2059

It will be noted from the marginal averages of Table I that all eight observations of density are used for comparing the density at 1 atmosphere pressure with that at 2 atmospheres and also for comparing the two temperatures. These same eight observations can be used to check the existence of interaction by averaging the diagonals $\frac{(a)+(d)}{4}$ and $\frac{(b)+(c)}{4}$. If these diagonal averages differ (as they do), the relationship between temperature, pressure, and the density of air is not a simple linear relationship. Had combination (d) not been tested, as is frequently the case in conventional chemical experimentation, no information on interaction would have been obtained, and the precision of the experiment would have been greatly reduced because the pressure and temperature observations must be treated separately, thus reducing the number of observations in each average by one half.

LATIN SQUARES

When many factors or many levels of each factor must be explored, factorial experiments may become impractically large. Thus the factorial design for eight factors at two levels requires $2^8 = 256$ combinations plus duplications for estimation of experimental error.

One method of reducing the amount of work is to sacrifice information on interactions by confounding them with the main effects of the factors. This procedure is risky in the sense that interaction effects are confused with main effects; but if the experiments are intended to scout a great many factors in a preliminary way, a great deal of effort can be saved which, with factorial designs, might be expended on unimportant factors. In any case it is better to include interactions in the average effects of the factors than to ignore them as is the practice with most nonstatistical designs.

Latin square designs allow a large number of factors to be evaluated with a minimum of work. The most useful of the Latin squares in chemical investigations is the 2 x 2 square which contains four combinations of three factors, each at two levels. For example, two levels of catalyst concentration, C_1 and C_2, two levels of temperature, T_1 and T_2, and two levels of agitation rate, A_1 and A_2, might be explored simultaneously for their effect on the rate of a polymerization process by observing the following four combinations:

(1) $A_1C_1T_1$	$A_2C_1T_2$	(2)
(3) $A_1C_2T_2$	$A_2C_2T_1$	(4)

The effect of changing the level of each of the three factors can then be determined by computing the following averages:

Agitation rate

$$A_1 = \frac{(1)+(3)}{2}$$

$$A_2 = \frac{(2)+(4)}{2}$$

Catalyst concentration

$$C_1 = \frac{(1)+(2)}{2}$$

$$C_2 = \frac{(3)+(4)}{2}$$

Temperature

$$T_1 = \frac{(1)+(4)}{2}$$

$$T_2 = \frac{(2)+(3)}{2}$$

Duplicate observations must be

made on each combination to provide an estimate of error.

The degrees of freedom for this Latin square are assigned as follows:

Source of Variation	*Degrees of Freedom*
Agitation rate	1
Catalyst concentration	1
Temperature	1
Total	3

It will be noted by checking back to the 2 x 2 factorial arrangement that the temperature effect has been confounded or confused with the agitation rate-catalyst concentration interaction and therefore the temperature averages have been altered by this interaction if it exists. For this reason, a Latin square experiment that shows important effects should be expanded into a factorial design (by running the four combinations which make up the mirror image of the Latin square) and the interactions estimated.

Larger Latin squares than the 2 x 2 are possible, although when dealing with factors rather than varieties these are not too useful; larger numbers of levels of each factor must be tested, and this is not usually desirable in the early stages of an investigation.

A 3 x 3 Latin square can be used to evaluate four factors, A, B, C, D, each at three levels:

$A_1B_3C_1D_3$	$A_2B_1C_2D_2$	$A_3B_2C_3D_1$
$A_2B_2C_3D_2$	$A_3B_3C_1D_1$	$A_1B_1C_2D_3$
$A_3B_1C_2D_1$	$A_1B_2C_3D_3$	$A_2B_3C_1D_2$

It will be noted that all batches containing A_1 can be averaged and compared with those containing A_2 and A_3 because in the totals for each of these averages the three levels of each of the other three factors occur once and only once.

The eight degrees of freedom for this 3 x 3 Latin square are assigned as follows:

Source of Variation	*Degrees of Freedom*
Factor A	2
Factor B	2
Factor C	2
Factor D	2
Total	8

The batches must be replicated in order to provide degrees of freedom for estimating the experimental errors.

A great many Latin square designs are known and many of these have been tabulated by Fisher and Yates.[4]

CONFOUNDED EXPERIMENTS

Methods of confounding various effects have been developed which are more complicated than the Latin square designs. The analysis of these becomes complex in certain cases. The purpose of these designs may be either to reduce the labor required to evaluate certain interaction relationships or to eliminate heterogeneous influences which might increase the experimental error.

The simplest of the designs for eliminating heterogeneity is the *quasi-factorial* (with two groups of sets) or *lattice square* in which the heterogeneous factors are treated as the main factors of a factorial experiment.

A simple example of this design is the testing of four catalyst preparations in a process where a single gas stream is split between only two reaction furnaces. If only two catalyst preparations can be tested at the same time on the same stream, and the stream varies in purity and composition from time to time, it poses something of a problem to compare efficiently four preparations. The lattice square arrangement of the four catalyst preparations, C_1, C_2, C_3, and C_4, would be as follows:

Run I C_1C_3
Run II C_2C_4
Run III C_1C_2
Run IV C_3C_4

or writing this as a square:

	RUN I	RUN II
RUN III	C_1	C_2
RUN IV	C_3	C_4

The degrees of freedom of this experiment are assigned:

Source of Variation	*Degrees of Freedom*
Runs	3
Catalyst preparations	3
Interaction (error)	1
Total	7

By this arrangement the four preparations have been evaluated by testing four of the six possible combinations of the four preparations taken by pairs. The reduction in required number of combinations by lattice square designs over combinatorial testing (testing all possible combinations) becomes greater with larger numbers of batches. For example, an 8 x 8 lattice square for 64 varieties of catalysts would require 2 x 64 = 128 determinations while the number of combinations equals

$$\frac{64!}{(64-8)!\,8!} = 4.42 \times 10^9.$$

Obviously combinatorial testing is never practiced with large numbers of varieties.

Because there is little possibility that the run-catalyst interaction will be appreciable, these interaction differences serve as an adequate estimate of experimental error, provided that a sufficient number of degrees of freedom is available to give the required precision. It is usually necessary to duplicate some of the combinations in different runs to provide enough degrees of freedom for a satisfactory estimate of errors.

This duplication is not entirely productive because more runs are required, the heterogeneity of which must be eliminated. For example, if each of the four combinations of the four runs of the lattice square were duplicated in four more runs, the degrees of freedom would be assigned:

Source of Variation	*Degrees of Freedom*
Runs	7
Catalyst preparations	3
Error	5
Total	15

Therefore eight additional tests have produced only four additional degrees of freedom for estimating errors.

The methods of confounding may become quite complex. The objective here is to point out to those unfamiliar with statistical designs that solutions are known for many of these problems. Many incomplete designs other than lattice squares are discussed in texts on statistical designs.

MISCELLANEOUS TECHNIQUES

A common question in planning experiments is that of the number of observations to be taken. If a desired precision, P, is required in the average of the observations, the number of observations, N, to give this precision (with 95% confidence) is:

$$N = \frac{4s^2}{P^2}$$ where s is the standard deviation of the observations. Unfortunately this standard deviation is not always known. A rough estimate may be made of the standard deviation by taking ⅛ of the estimated extreme spread in observations. If no guess can be made, the observations should

(*Turn to page 688*)

New Process Eases Pigment Manufacture

TITANIUM SLAG CONCENTRATE obtained by smelting iron titanium ores is superior for processing to titanium pigments, iron is recovered as marketable pig iron.

ALTHOUGH Quebec Iron and Titanium Corp.'s project to make pig iron and a high-titanium slag has been disclosed (*CI, January 1950, p. 24*), little has been revealed of the process by which these ends will be accomplished.

A recent patent (U. S. No. 2,476,453) issued to that firm, however, delineates the general outline and tells many of the details of the process that may be used.

Previous efforts to smelt such titaniferous ores as occur in Quebec have failed—largely because the titanium gave rise to intractable slags in ordinary flux smelting processes. Heretofore it had been thought that large quantities of fluxes—lime, soda, or alumina—had to be used in order to get slags fluid enough to permit separation from the iron and tapping from the furnace.

But large amounts of fluxing agents dilute the slag, make it uneconomical to recover the titanium content. Quebec Iron's secret of success: control of the charge conditions to produce a titanium slag concentrate with little or no added flux and at the same time yield a marketable pig iron.

TITANIUM SLAG CONCENTRATE VS. ILMENITE

Slag Process	Ilmenite
Iron recovered as high-value pig iron	Iron recovered as low-value copperas
Pigment produced directly from leach solution	Leach solution requires precipitation of copperas
Digestion and leaching are accomplished rapidly	Digestion and leaching may require twice as long as slag
May contain insoluble residue	Insoluble portion is negligible
Smelting requires 0.8-1.3 KWH per lb. of ore	Ore is ground and digested directly

HIGH CONCENTRATION

Outstanding characteristic of the slag is its high titanium content—60 to 70%, calculated as TiO_2. Another characteristic is its good digesting properties under the ordinary commercial conditions of acid digestion and leaching. Recovery of titanium in the leach solution is 80 to 85% or higher.

These properties, together with the high titanium-to-iron ratio compared with currently-used concentrates, permit production of pigments directly from the leach solution without the necessity, as in ilmenite processing, of crystallizing out part of the iron as ferrous sulfate (copperas).

A further characteristic of the slag is that there is present a moderately low proportion of lower titanium oxides (Ti_2O_3, Ti_3O_5, etc.). Some are present—and, indeed, are necessary, for the greater the reduced titania content, the lower the iron content and the reducing action of the lower oxides keeps the iron in the desired ferrous state. Part of the excess lower oxides are oxidized to the TiO_2 stage, however, during acid digestion and leaching.

SMELTING OF ORE

A charge of ore, coal and flux is smelted in an electric arc furnace, the proportions being correlated to give pig iron and slag at a temperature of 1500 to 1700° C. The required high concentration of titanium in the slag is attained by limiting the flux: Maximum amount of lime added is 10% of ore weight, preferably not more than 6%, and varying from that down to none at all.

Contrary to conventional smelting practice, an excess of coal is avoided. Amount of coal included in the charge mix is slightly less than that theoretically required to reduce the iron oxide in the ore (with oxidation of the carbon to carbon monoxide) and to carburize the iron. In general, this will range from 8 to 14% of ore weight. A low-ash coal is desirable, since the ash content of the coal enters and hence dilutes the slag.

Ores particularly suitable for producing slag concentrate have the following composition:

Titanium dioxide (TiO_2)	30-50
Iron (Fe)	30-50
Gangue	Up to 12

Typical analysis of a suitable ore is:

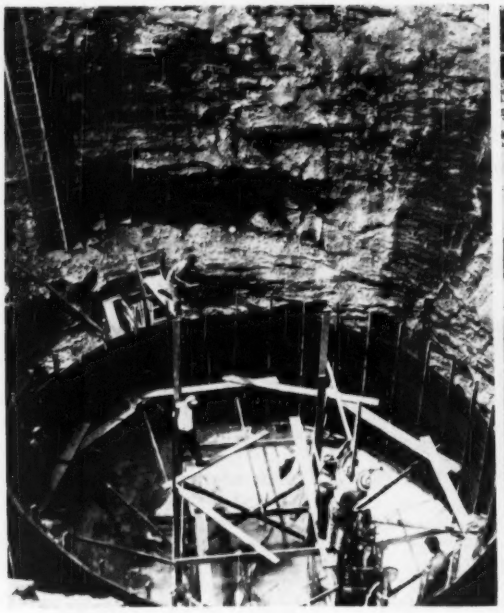
	Per cent
Iron (Fe)	36.8
Titanium dioxide (TiO_2)	39.5
Lime (CaO)	0.5
Magnesia (MgO)	4.0
Alumina (Al_2O_3)	2.6
Silica (SiO_2)	2.7
Phosphorus pentoxide (P_2O_5)	less than 0.02

The gangue constituents, coal ash, practically all of the titanium dioxide, whatever iron (as ferrous oxide, FeO) passes into the slag, and added flux constitute the slag. It is desirable to hold extraneous additions to a minimum to give as high a titanium concentration as possible. Only enough is added to give the slag proper fluidity at 1500-1700° C, below which temperature range the iron is insufficiently reduced and above which the titanium is reduced to the highly viscous lower oxides. Under optimum conditions the slag will yield, after digestion and leaching, a solution containing preferably not more than 15% of the titanium in lower valence states.

DIGESTION AND LEACHING

In processing the slag, it isn't enough to get a reasonable titanium recovery: the titanium sulfate solution obtained must, upon hydrolysis,

(*Turn to page 792*)



WATER from the Lake Huron inlet enters the suction well (shown under construction) to be pumped to Saginaw and Midland.

CONCRETE PIPE, 48" in diameter, carries water 50 miles from Lake Huron to the junction between the Saginaw and Midland lines.

Lake Huron Comes to Dow

EDITORIAL STAFF REPORT

LAKE HURON NOW PROVIDES Dow Chemical Co. at Midland, Mich. with a needed supply of softer water to demineralize for boiler feed.

THERE comes a time in the life of every rapidly growing process unit when an increased water supply is a must. Dow Chemical Co. at Midland, Mich., had plenty of water available from its long-time source of supply, the adjacent Tittabawassee River. But the mineral content was extremely high, producing the usual problems of scaling and decreased heat transfer rates. Further, such hard water was extremely costly to demineralize by ion exchange methods.

And complete demineralization was necessary in conjunction with the planned increase in Dow's electrical generation facilities from 38,000 KW to 120,000 KW. Complete silica removal was of particular importance, as it was planned to utilize 1,250 psi boilers.

Deterioration of water quality also forced the City of Midland to start looking for a source other than the Tittabawassee at about the same time. A similar situation prevailed at nearby Saginaw, which drew its water supply from the adjacent Saginaw River.

FROM LAKE HURON

It was logical that the quest should turn toward Lake Huron, about 65 miles distant from both Saginaw and Midland. Aside from offering an unlimited supply, the lake water had a much lower mineral content and on the average was about twenty degrees cooler than the water from the Tittabawassee.

But here the dollar sign reared its ugly head. The necessary 65-mile pipeline would cost about $10 million. After much study it was started in 1947 as a joint undertaking of the cities of Midland and Saginaw and completed in October, 1948, with Dow guaranteeing to take a large portion of Midland's allotment.

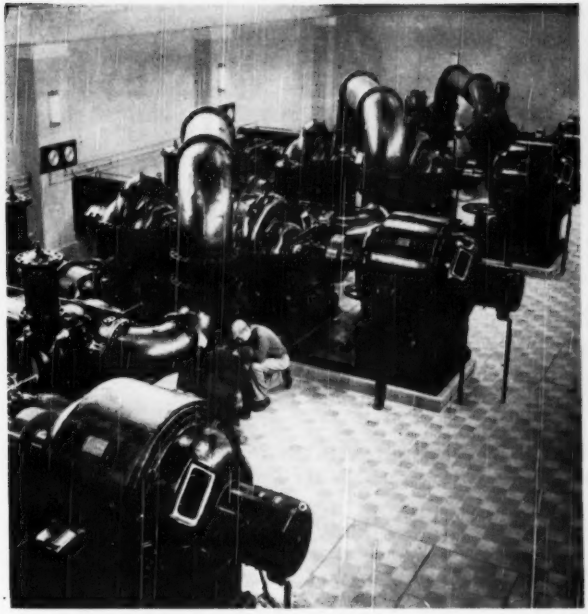
The system has a peak capacity of 71 million gallons per day with an average capacity of 43 mgd. This is split between the two communities—23 mgd for Saginaw and 20 mgd for Midland. These allowances are sufficient to permit the domestic use of water in both cities to double before another source must be looked for. Dow has guaranteed the City of Midland that it would take a minimum of 7 mgd over any year's period and, if needed, it has the privilege of doubling that amount.

Dow is still taking water from the Tittabawassee for general plant service, including fire protection and the operation of barometric condensers. The new system supplies water for certain heat exchanger operations and, after complete demineralization, for the new Cyclone boilers.

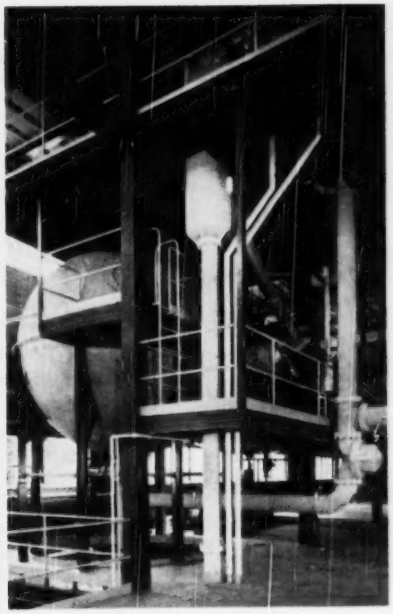
DEMINERALIZATION

The demineralization plant was installed in two parts. The first part, completed some time ago, has a treating capacity of 1.25 mgd. This will be raised to a total treating capacity of 4 mgd this month when the second section of the demineralization plant is completed—one of the two largest demineralization units of its kind in the United States.

There are two steps in demineralization. The cations are removed first, followed by removal of the anions. The cation-exchange resin used in the



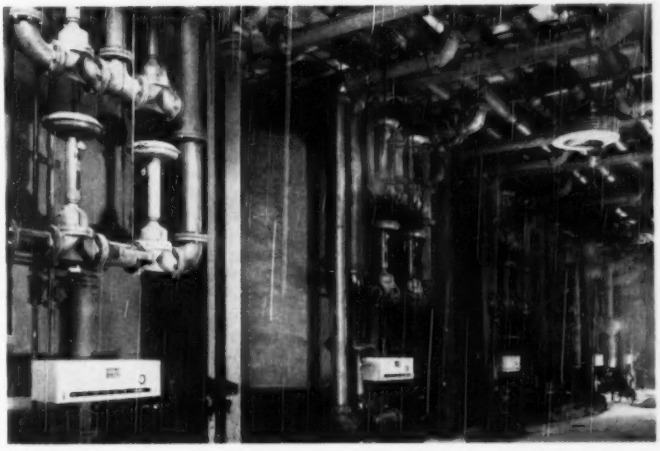
CENTRIFUGAL PUMPS at Lake Huron push water to the junction where two 36" lines carry it to Saginaw and the Dow plant, then to Midland with a 24" line.



DEAERATION removes oxygen and carbon dioxide. Three ejector stages produce the needed vacuum.

first part of the plant was of the phenol-formaldehyde type while Dowex 50 (Nalcite HCR) will remove the cations in the new section to be completed this month. Anions are removed by an aminated phenol-formaldehyde resin in the first part of the plant at Dowex 2 (Nalcite SAR) in the second.

Water from all of the cation exchange units discharge directly into a header which is common with that for the anion exchange units. After anion removal the treated water is deaerated before being pumped to the power plant. A five-foot depth of cation exchange resin lies on a bed of anthracite coal, and the exchanger shell is equipped with hard-rubber underdrains. The anion exchanger is completely rubber-lined.



DEMINERALIZATION takes place by contact with synthetic ion exchange resins. The system is capable of removing approximately 5000 pounds of dissolved solids from the water per day.

FLUORIDE REMOVAL

At first a suspension of calcium fluoride was injected into the bottom of the exchange bed for removal of dissolved silica. After a period of operation it was determined that the free mineral acidity of the water leaving the cation exchanger was not carrying a sufficient quantity of fluoride into solution for complete silica removal. At first the calcium fluoride was supplemented by addition of a soluble fluoride salt and eventually replaced entirely. Hydrochloric acid is used for regeneration of the cation exchange resin, while regeneration of the anion exchange resin is accomplished by a short wash of caustic soda followed by washing with a soda ash solution.

Three ejector stages are used in the Bituminastic-lined spherical design deaerator. Water from the after condenser is recovered for recirculation. This aerator provides a product with less than 2 ppm of carbon dioxide and 0.1 ppm of oxygen.

As yet data on the cost of operation of the demineralization plant are too meager to provide definite information on the cost of treatment. However, initial data (exclusive of building, equipment, and operating costs) show a cost for chemicals and rinse water (@ 12¢/thousand gallons of water) of 10.7¢/thousand gallons for cation removal; 3.5¢ for anion removal; 1.2¢ for fluoride removal. This gives a total cost for regenerated water of 27.4¢ per thousand gallons.

HOW TO DISPOSE OF ACID WASTES

by J. E. COOPER
Ford Motor Co., Detroit, Mich

IF YOU HAVE AN ACID WASTE . . .

1. Disposal by dilution is the least expensive and most satisfactory method for disposal if the body of receiving water is large enough to receive the waste flow.

2. Investigate the new acid neutralization process that utilizes limestone. It eliminates the need for acid pumps in the system.

3. Check the iron content. Promise for a market for some of the waste ferrous sulfate from pickling liquors is shown by a new process developed by the Ford Motor Co. It is used as a sewage sludge conditioning agent.

THE importance of pH control in industrial effluents is well recognized. Free mineral acidity which reduces pH below 4.5 produces lethal effects on fish life. Further, strong acid wastes destroy ordinary sewers and adversely affect biological methods of sewage treatment. For these latter reasons many municipalities are adopting ordinances which restrict the pH range of industrial effluents entering municipal sewage disposal systems.

The regulatory methods of State and Federal Agencies often take the form of stream or effluent standards. Schroepfer[1] has summarized many of these regulations. However, it is difficult for such standards to cover all circumstances, and there must be full cooperation between plant and regulatory authorities. Such cooperation will often obviate the necessity of detailed regulatory legislation.

DISPOSAL BY DILUTION

If a use cannot be found for a waste, it can either be diluted by adjacent water bodies or neutralized with alkali. Utilization of the volume and alkalinity of receiving waters for dilution and neutralization is usually the simplest procedure.

Basically, there are three requirements necessary for use of such a method:

(a) There must be enough receiving water to provide dilution.
(b) There must be sufficient alkaline buffer in the receiving water to neutralize the added acid.
(c) The wastes must not contain other pollutants whose concentration still remains excessive after the acid is diluted and neutralized.

As an example of the last point, tests in the Ford laboratory on disposal of an acid pickling liquor (7.3% acid as H_2SO_4 and 5.35% ferrous iron) showed that the Detroit River could assimilate 290 gallons of waste per million gallons of river water and still meet the pH standards of the International Joint Commission.[2] However, limitation of iron to 0.3 ppm by the Commission allowed only about 4 gallons of waste to be put into a million gallons of river water.

In some cases it will be possible to let acid wastes neutralize alkaline wastes. This may require holding tanks or basins for the acid or alkaline wastes, or both. Such holding facilities also permit even discharge of a waste to a sewer or stream, thus making maximum use of the dilution capacity of the receiving waters.

Another factor involved in acid disposal by dilution is the means of mixing or distributing the waste into the receiving water. Usually the traversing of a municipal sewer system for some distance provides this mixing. But when the disposal is directly to a lake or stream, rather elaborate means are required to disperse the waste into the receiving water to avoid localized lethal concentrations.

Generally speaking, the industry representative, in negotiating disposal by dilution of acid pickling liquors to a municipal sewage system, is met with all the reasons "why it shouldn't or can't be done." At Kenosha, Wisconsin,[3] it was found that the waste acted as coagulants and, with the aid of mixing tanks, uncontrolled chemical treatment of sewage was in effect. When other toxic metal salts, such as chromium, copper, and zinc, are absent, it appears that the limited addition of pickling acids containing iron benefits the treating process.

NEUTRALIZATION

When disposal by controlled dilution cannot be accomplished, neutralization with alkali is required.

There are many excellent studies and reports on neutralization.[4, 5, 6, 7] Undoubtedly the most auspicious of these is the work which has been carried on at the Mellon Institute by Hoak, et al,[8, 9] as a part of the research program of the Stream Pollution Committee of the American Iron

Based on a paper presented before the Society of Automotive Engineers Passenger Car, Body, and Production Meeting, Detroit, Mich., March 14-16, 1950.

and Steel Institute. It has provided the most complete technical information yet available on the use of lime and limestone, methods of evaluating same, studies on the economic and technologic factors involved, and recently,[10] a new technique for neutralization. The resulting sludge from this process has a much smaller sludge volume and is more amendable to vacuum filtration.

In neutralizing acids, limestone beds of many descriptions and designs have been incorporated in industrial sewer systems. Some have been successful, others complete failures. Without going into design details which depend largely on local conditions, following are some of the factors which must be considered if a limestone bed is to function satisfactorily:

(1) Limestone as such ($CaCO_3$ + $MgCO_3$) can in itself neutralize only free acidity. (Final pH 4.2.) The reaction, however, produces large quantities of carbonic acid (H_2CO_3) which can be removed by aeration: $H_2CO_3 \rightarrow H_2O - /CO_2$. Following aeration the pH is raised to about 6.0, which is satisfactory in most cases.

(2) Acid strength must be kept below 0.5% H_2SO_4 to keep the resulting $CaSO_4$ in solution and not allow it to coat the limestone and make it inactive.

(3) Flow rates[4] of 0.5 to 1 gal./min./sq. ft. of bed area (downflow type) when the bed is 5' deep will successfully neutralize sulphuric acid. An 18"-24" upflow bed is reported by Gehm[10] to handle 40-50 gals./min./sq. ft.

(4) High calcium limestone (95% $CaCO_3$) should be used rather than dolomitic limestones due to higher reaction rates.

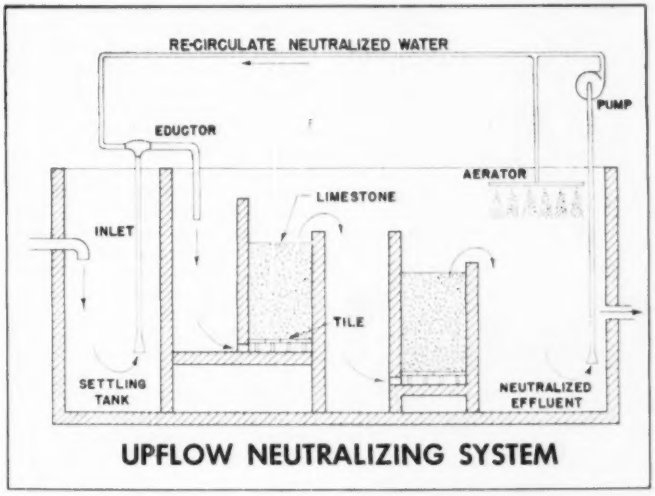
(5) Suspended matter must be kept low. Greases and oils should be skimmed from waste before it enters the bed.

(6) Stone size is important. No. 2 limestone chick-gravel is readily available and very acceptable. (1-3 mm. size in the upflow type. In the downflow type 1-3" stone is the most generally used size.)

In 1947 the General Electric Co.[6] installed an interesting up-flow limestone neutralizing system in its Philadelphia works. A second installation in 1949 was approximately three times as large. Much of the experimental work which preceded this installation was carried on by Gehm.[10]

In the smaller plant the flow rate averages 200 gpm for 8 hours and contains 150-200 gallons of acid waste. The limestone consumption averages between 5 and 10 cu. ft./day. The recirculating system flow rate is 600 gpm, of which 400 gpm is delivered to the eductor and 200 gpm to the aerator. Acid wastes average between pH 3.9 and 4.4 during normal operation and drop to a pH of 1.9 during discard of concentrated acid baths.

Unique in the scheme is the use of an eductor to pick up acid from the primary holding section and lift it to the beds. This eliminates the need for expensive and difficult-to-maintain acid pumps and provide a controlled volume to the beds, necessary for successful operation. The important feature in this installation is its relative simplicity, yet complete effectiveness.



UPFLOW NEUTRALIZING SYSTEM

OTHER DISPOSAL METHODS

As a result of cooperative research between the Ford Motor Co., the City of Detroit, and the City of Dearborn,[11] waste steel pickling liquor from Ford's steel mill is now replacing ferric chloride in sewage treatment plants as a sewage sludge conditioning agent. In all sewage treatment plants which use settling tanks for the separation of suspended solids from the water carrier, it appears that the treatment of the incoming sewage with lime and acid wastes containing iron will improve solids removal.

It is now possible for sewage plants using chemical methods for sewage sludge conditioning to use the iron available in acid-iron wastes rather than purchase ferric chloride. This provides a benefit to both the producer and the sewage plant. The results at the sewage plants appear thus far to be satisfactory under all operating conditions.

Research work is now being directed toward an acid recovery process which has as its end products acid to return to the steel mill and a ferrous sulfate solution with only enough sulfuric acid present to prevent hydrolysis. It is hoped that this ferrous sulfate solution can be developed as a sludge-conditioning agent.

The Akron, Ohio, water purification plant has also used waste steel pickling liquor as a coagulant in water purification in place of acid in conjunction with alum.[12] Chlorinated pickling liquor is reported to give more economical plant operation.

In the future the use of spent acids containing iron should be more widespread as industry becomes familiar with the fact that iron salts in these acids have a definite use in water and sewage purification.

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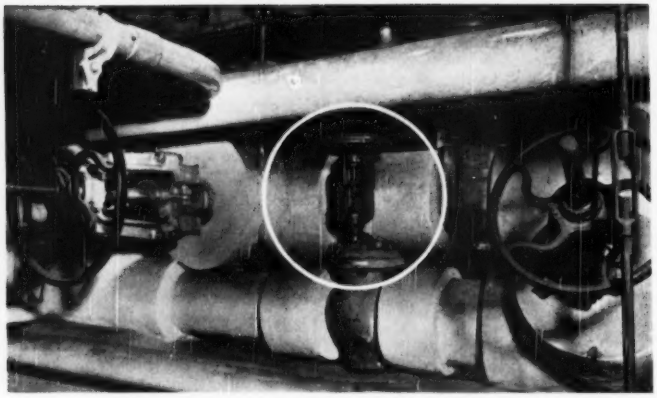

SPILLOVER VALVE installed at Socony-Vacuum Oil Co. plant.

How to Select a Control Valve

by JOHN PROCOPI
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

TO PROPERLY SELECT AND USE a control valve, you must recognize its capabilities and limitations—know what it can and can't do.

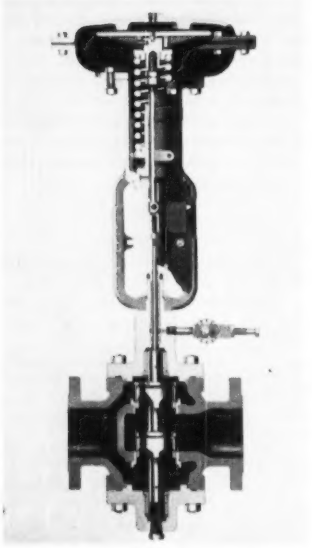

FIGURE 1—High lift diaphragm valve (double-ported).

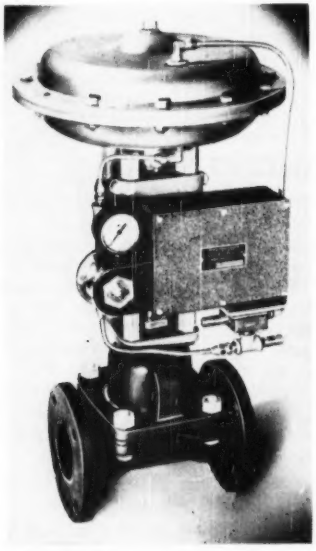

FIGURE 2—Springless motor operator on Saunders patent valve.

A CONTROL valve may be described as a variable resistance in a fluid flow system. In any automatic control installation, it is as important a component of the system as is the control instrument.

Control valves may be operated by pneumatic, hydraulic, electric or hand power. Since the pneumatic or diaphragm motor-operated valves are much more widely employed than other types, this article is limited to considerations in the selection of diaphragm motor control valves.

POWER UNIT

Basically, the valve assembly comprises a power unit (or diaphragm motor) and valve body. Two types of pneumatic operated power units are commonly employed: the spring-opposed and the springless diaphragm motor.

Spring-Opposed Diaphragm Motor. This power unit (Figure 1) has a flexible diaphragm with a pressure-tight chamber on the upper side to which the air output of the controller is connected. A compression spring assembly is coiled on the under side of the diaphragm. A stem connects the diaphragm plate to the valve disc. Air pressure applied to the top of the diaphragm creates a force equal to the product of air pressure multiplied by the area of the diaphragm. As the diaphragm moves downward, the spring compresses and creates an opposing force which, when equal to the downward force, results in a balanced position of the diaphragm and valve disc.

In the design of the diaphragm motor, certain fundamental principles must be followed. As the spring opposes the air loading pressure, it is desirable that a uniform increment of valve travel or lift be obtained from the energy expended. In other words, the ideal curve when plotting air pressure on the diaphragm member versus inner valve movement is a straight line. This characteristic is essential to satisfactory control, to cause uniform variance of inner valve position with changing loading pressures. The design characteristics also should be such that a minimum of friction is introduced.

Closely allied to friction is the characteristic referred to as hysteresis. This may be defined as the difference between the valve stem position, resulting from an increase in air pressure to a given value, and that resulting from a decrease in air pressure to the same value. It is plotted over the entire range of air pressure and stem travel as two curves which form a closed loop. Excessive friction produces a wide hysteresis loop due to the inability of the control valve to

reproduce a given position when the same pneumatic loading pressure is reproduced on the diaphragm.

There are numerous details of design and construction which must be closely watched if hysteresis in a control valve is to be kept at a minimum. Springs must be well made and carefully selected. Diaphragm material should be as flexible as possible consistent with strength and durability. Machine and assembly work must be of the highest caliber in order to eliminate any chance of binding and sticking outside of the stuffing box.

In an automatic control system, the phenomenon of cycling or hunting may be a manifestation of a wide hysteresis loop. For example, if the area of the diaphragm is 100 sq. in. and the applied air pressure is seven psi, a total force of 700 lb. acts downward on the valve stem. This force compresses the spring until equilibrium is reached by an equal and opposite reaction and the inner valve comes to rest. Now assume that the instrument calls for a new valve position, which position would be obtained by an air pressure of seven and one-quarter psi. This extra one-quarter psi gives an additional total applied force of 25 lb. on the diaphragm. It is conceivable that a 25-lb. opposing force exists in the form of friction in the stuffing box and valve superstructure. In such a case, the valve fails to reach the position called for by the instrument and the controlled variable continues to rise until the instrument raises the air pressure high enough so that the total applied force on the diaphragm overcomes the frictional force. This, of course, causes the valve to jump to a new position which is beyond that required for control, and the result is cycling or hunting.

Springless Diaphragm Motor. In the spring-opposed diaphragm motor, just described, the spring is required to coordinate the valve position with the instrument air pressure, but while functioning it absorbs the power provided by the diaphragm motor and leaves little power available to overcome the unbalance in the valve. In certain types, such as Saunders patent single-seated and butterfly valves, a high differential pressure across the valve results in a large stem thrust or unbalance. This must be overcome by the diaphragm motor. There is available for this application a springless diaphragm motor (Figure 2) whose power is a direct function of effective air pressure and diaphragm area.

The power-absorbing spring is eliminated in this motor and the underside of the diaphragm is loaded pneumatically with a constant air pressure which can be adjusted to suit conditions. The top is loaded automatically, through a force balance type of valve positioner, to any pressure required to hold the position dictated by the control instrument. The loading on one side or the other (depending upon the direction of the thrust) can be set at a minimum, thereby making maximum differential pressure available across the diaphragm for overcoming thrusts. For example, if the pressure on the underside of the diaphragm is set at 15 psi, with a 30 psi supply to the positioner, there is available a differential pressure of 15 psi. With an 80-square inch diaphragm, this amounts to 1200 pounds loading.

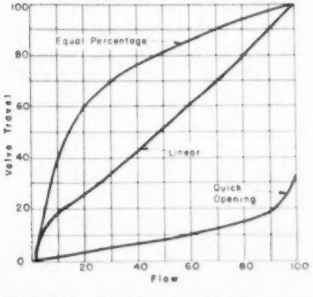

FIGURE 4—Flow-lift characteristic curves.

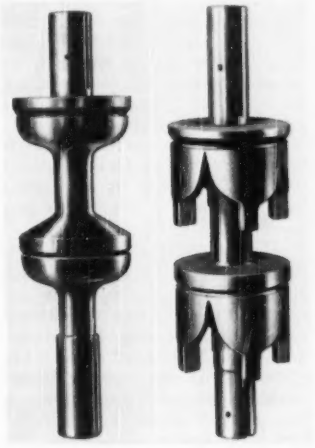

FIGURE 3—Linear plugs.

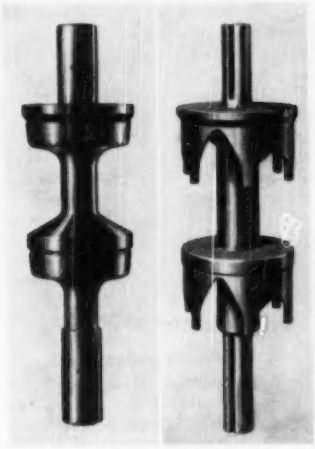

FIGURE 5—Equal percentage plugs.

BODY MEMBER

The most common type of valve body used for control purposes is the globe type, which is comprised of (1) a stuffing box, (2) inner port, and (3) inner valve.

Stuffing Box. The stuffing box functions to seal the fluid flowing through the valve body while permitting the valve stem to pass through as freely as possible. A nut is provided at the top of a sealing gland to permit access to the stuffing box chamber and provide a means of tightening the seal by compression on the packing material. Since this chamber can be the most serious cause of friction on the valve stem, the packing and lubricant for most fluids should provide an adequate seal with hand tightening of the gland nut. To further promote free action, the stem is highly polished. Good engineering practice today accepts a packing depth of six times the diameter of the stem member.

Fluids at temperatures above 450° F cause excessive drying of the lubricant. For such applications, radiating fins are used to dissipate the heat before it reaches the stuffing box. Similarly, when fluid temperatures are below 32° F, an extension column should be used to separate the stuffing box from the valve body. This prevents stuffing box lubricants from becoming too viscous and also prevents frosting of the valve stem.

Single vs. Double Port. Valve bodies are available in single- or double-port construction. The inner port is described as the opening within the valve body into which the valve plug seats to throttle the flow.

In single-port valves, differential pressure acts over the entire bottom of the valve plug to create a vertical force on the valve stem. When the valve plug is in the closed position, moreover, the downstream pressure in many applications drops practically

to zero. This increases the pressure differential across the valve so that the vertical thrust may constitute an appreciable force. The power unit must overcome this force in order to hold a direct acting (air-to-close) valve closed or to open a reverse acting (air-to-open) valve. For proportional control, the effect of stem thrust is obviously undesirable.

The double-port body was designed to minimize the undesirable effects of this thrust. The inlet and outlet fluid pressures tend to balance themselves by acting both upward and downward on the two valve discs, resulting in what is termed a semi-balance valve. For practical construction, however, the upper port is usually made slightly larger than the lower so that the lower valve disc may pass through the upper port when the inner valve is installed.

The double-port construction has one disadvantage. With variation in temperature, the stem portion connecting the two valve plugs contracts or expands linearly a different amount than the valve body. In the closed position, therefore, one valve disc seats first and prevents the second disc from seating completely. This results in a minimum or "leakage" flow. Thus, when tight shut off is required, a single port valve must be used.

INNER VALVES

Most important factor in the overall performance of the control valve is the flow characteristic, which in effect describes the manner in which the control valve acts. The term "inherent valve characteristic" is used to denote the relation between stem position and flow under constant pressure drop. When the drop or pressure differential does not remain constant, as usually occurs in service, the characteristic curve is manifestly modified to provide what is termed the "effective valve characteristic."

THREE TYPES

There are three common types of inner valves: (1) quick opening, (2) linear, and (3) equal percentage.

Quick Opening. This a bevel-seated or poppet-type inner valve in which the area of the opening is determined by the perimeter of the disc times its valve lift. There are no restrictions after the inner valve leaves the seat, and the valve reaches maximum capacity at a relatively small proportion of lift. This type of valve is generally used for open and shut service.

There are numerous applications where process characteristics are such that adequate control cannot be obtained by a two-position valve of this type. Rather, the control element must possess a throttling characteristic or an ability to assume intermediate positions in its full travel, as dictated by the control instrument. This throttling valve must possess a higher lift than the on-off valve, since the higher the lift, the simpler it becomes to obtain a characteristic. These so-called high-lift valves are generally furnished with either linear or equal percentage inner valves.

Linear Plug. This inner valve is supplied either as a V-port disc or as a solid plug (Figure 3.) The choice of either V-port or solid plug in clean service is largely a matter of user preference. The solid plug is a better selection when there is a possibility of plugging or erosion due to the presence of suspended solids in the fluid. The flow-lift plot for this plug is a straight line on rectilinear coordinates, giving equal volume changes for equal stem changes, regardless of per cent of valve opening (Figure 4). This type of characteristic is needed where pressure drop in the system is largely concentrated in the control valve and most of the energy must be dissipated by it.

Equal Percentage Plug. As with the linear inner valve, equal percentage disc may be either V-ported or solid (Figure 5). The flow lift curve at constant pressure drop is a straight line on semi-logarithmic paper. A control valve with this characteristic will produce a constant rate of change in flow per unit change in lift at constant pressure drop (Figure 4). This change is always an equal percentage greater or smaller than the flow that existed at the moment preceding the increase or decrease in lift.

In general, the equal percentage inner valve can be used to advantage:

A. Where only a small percentage of the total system pressure drop is available across the valve.

B. When a control valve is in series with pumps, heat exchangers and other resistances. Here pressure drop across the valve is likely to be low at high rate of flow but high at low flow. Even with variable flow and pressure drop, the equal percentage characteristic provides uniformly satisfactory control at any point of lift in excess of clearance leakage.

C. When operating conditions cannot be determined and it is necessary to install a line-size valve. It is rather difficult to oversize a valve with an equal percentage characteristic, which basically has the following capacities:

Valve Lift	*Per Cent Total Flow at Constant Differential Pressure*
25%	7 — 8%
50%	12.5 — 15%
75%	37 — 40%
100%	100%

Even the most carefully designed diaphragm motor valve will not function at its best if improperly sized. Oversize valves wear out rapidly. A valve which is working too close to its seat tends to wire draw across the seating surface, resulting in early unserviceability. Valves should be selected from any manufacturer's capacity tables or charts.

Mathematical Design of Equipment

(Continued from page 680)

be made in a sequential fashion, a calculation being made of the standard deviation after a few observations have been completed.

SAMPLING

A pitfall to reliable experimental results is improper sampling. An analysis of an experimental batch may be meaningless if the batch is not made homogeneous, either by mechanical mixing or by the sampling procedure. A proper sample must satisfy two criteria: it must be valid and it must be representative.

Both of these qualifications are elements of degree, and the degree of validity is determined by the care exercised in obtaining a random sample, while the representativeness of the sample is determined by the degree to which the proportion of each kind of material in the sample corresponds to the proportion of that kind of material in the batch.

A random sample is obtained by taking it in such a fashion that each unit of a particular kind of material in the batch has an equal chance of being selected for the sample. A representative sample is obtained by blending the different kinds of material (selected by a random choice from within each kind of material comprising the batch) in exactly the same proportions as in the batch being sampled.

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THE CHEMICAL PANORAMA

NEWS OF THE CHEMICAL PROCESS INDUSTRIES IN PICTURES

T. G. HUGHES, elected president, Oronite Chemical Co. to succeed G. L. Parkhurst. He has been executive vice president this last year.

J. ALBERT WOODS, elected president of Commercial Solvents Corp. He has been president of Wilson and Toomer Fertilizer Co.

PEOPLE

ERNEST H. VOLWILER, elected president and general manager of the Abbott Laboratories.

JAMES W. EVANS, recently appointed director of research, American Maize-Products Co.

CHARLES A. KRAUS of Brown University, who will receive the Priestley Medal of the American Chemical Society at its fall meeting.

WARREN L. SMITH, elected president of the M. W. Kellogg Co., succeeding H. R. Austin.

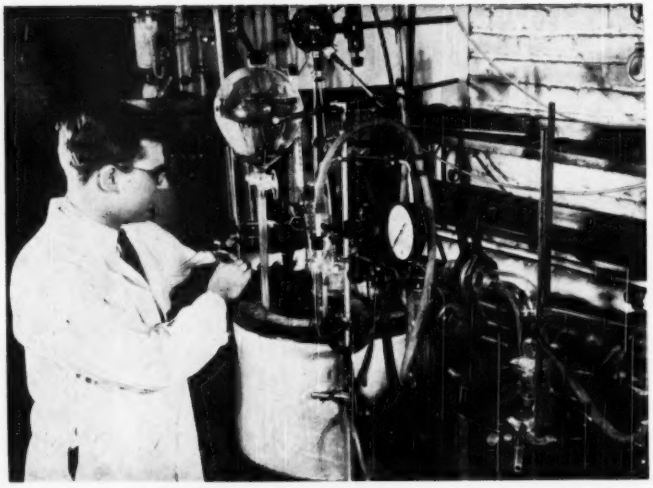
JOSEPH E. BAKER, named vice president and general manager, Mathieson Chemical Corp.

MORE CORTISONE

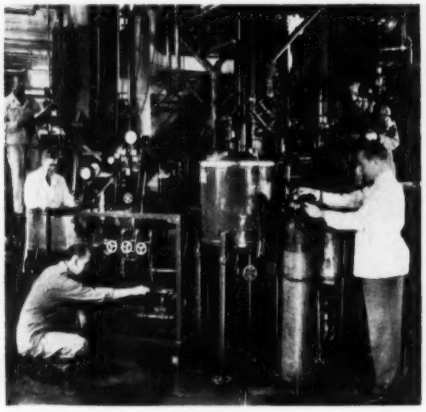
Large-scale processing ups cortisone output, cuts cost.

NEW TECHNIQUES and processes for producing cortisone by factory methods have been developed by Merck and Co. The synthesis of cortisone is a delicate procedure that requires painstaking supervision at all times. It has been necessary to design equipment amenable to control by techniques practical in the factory which will guarantee the maximum possible yield from each of the multiple step procedures, and not lessen the purity of the product.

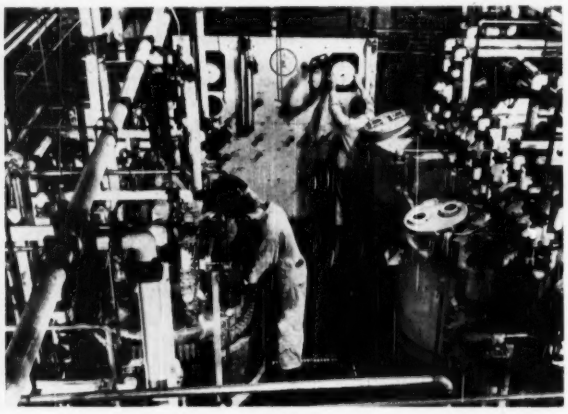
Merck's production has reached the point where it is measured in thousands of grams per month. Late in 1948 supplies amounted to only a few grams, and during 1949 monthly production was measured in hundreds of grams.



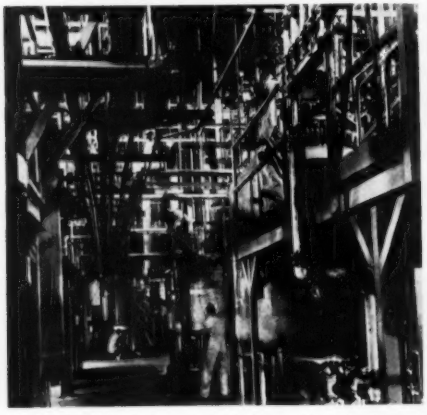
The final step in the large-scale synthesis of cortisone. It is expected that production will be sufficient to permit the start of commercial distribution in the latter part of the year.



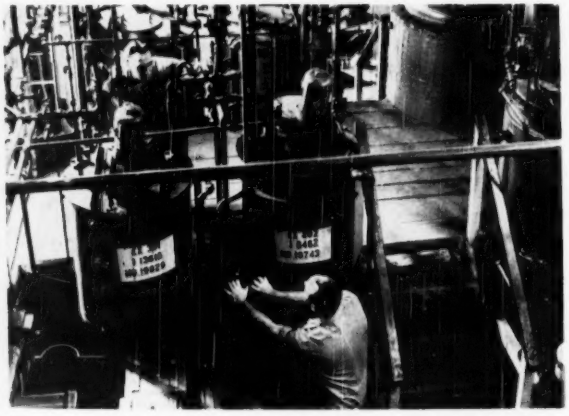
Chemists, chemical engineers and operators working on development of the process. New steps were tried many times.



Glass-lined equipment and porcelain piping, necessary in several steps of the process. Experiments are being made to make present methods less complicated.



Some of the equipment used. Increased production rates have permitted price reductions from $200 to $110 per gram.



Operators manipulating extractors in the final stages of manufacture. Great care must be taken to prevent loss of product in each of the multiple-step procedures.

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Grades: Crystalline, powdered, and powdered F. F. (free-flowing)
Typical Analysis:

NH_3 (min.)	14.5%
P_2O_5	61.0%
pH (1% solution)	4.5

VICTOR DIAMMONIUM PHOSPHATE

$(NH_4)_2HPO_4$

A brilliant white crystalline material, mildly alkaline in reaction.
Meets all U. S. Pure Food Law requirements.
Grades: Crystalline, powdered F. F., and dentifrice.
Typical Analysis:

NH_3	25.3%
P_2O_5	53.5%
pH (1% solution)	8.0

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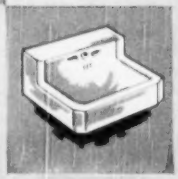

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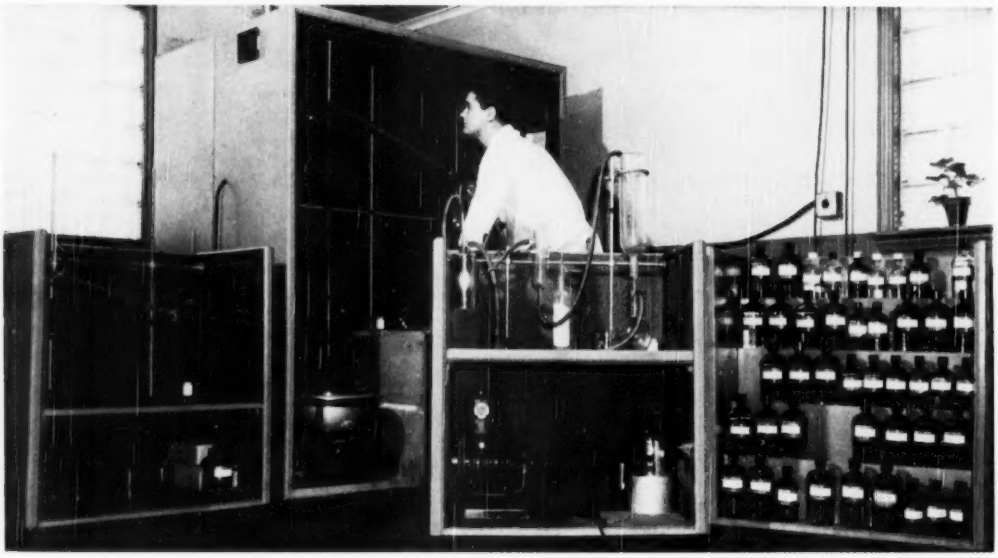


One of the larger laboratories. This has no desks or furniture, but there are regularly spaced outlets for electricity, gas and water.

LABORATORY FOR PRODUCTION

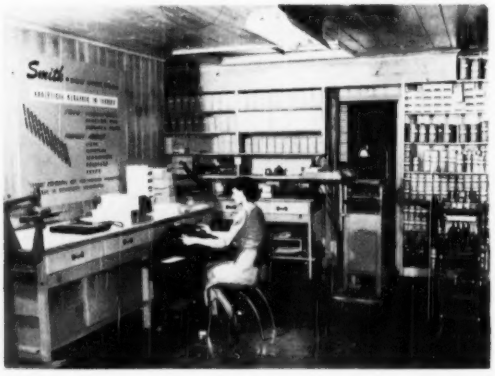
Newly-completed Smith-New York laboratory uses "unit operations" equipment units for production of fine organics.

SMITH-NEW YORK has recently completed new laboratories at Freeport, N. Y., for the production of laboratory chemicals. An unusual design feature is the use of mobile, functional units, each one for a specific purpose. Each unit is equipped with all the apparatus and supplies necessary for using it. There are several filtration units, distillation units of all sizes for low and high vacuum, mixing units and so forth. This arrangement facilitates experiment and production.

One of the labs is equipped with rods going from ceiling to floor to simplify apparatus assemblies extending over a wide area. Another joins a terrace to which facilities are connected for outside work involving dangerous materials.

Walton J. Smith, president of Smith-New York, at the lab.

Lab equipped with ceiling to floor rods for apparatus assemblies.



Portion of the mailing room. All rooms are colorfully decorated.

Quality Means More than Price

Some chemical buyers make the mistake of considering price alone, forgetting other essentials such as quality, service, and product improvement.

Innis, Speiden offers you chemicals, gums and waxes at current market prices. In addition, Isco provides, at no extra cost, quality and service . . . These Isco extras actually mean lower costs to you through improved production.

When buying chemicals, gums or waxes, let an ISCO representative explain the advantages of ISCO-operation. Remember, in purchasing, it's wise to look for more than a bargain basement . . . You get more when you buy from ISCO.

ISCO CAUSTIC POTASH

REGULAR GRADES
for all purposes
FLAKE—SOLID—90%
CRUSHED AND BROKEN
LIQUID FF 45-50%

SPECIAL QUALITY
Liquid FC 45%
Extra low in chloride and iron—for use where special purity is required.

AMERICAN SELECTED WALNUT CAUSTIC POTASH
For the absorption of moisture and CO_2 in the air liquefaction industry

CARBONATE OF POTASH
Calcined 99-100% Hydrated 83-85%
Liquid 47-48%
These products are of highest quality, practically free of chlorides, sulphates and iron.

• • •

Produced in the Isco Plant at Niagara Falls, N. Y.
Stocks maintained at New York and Branch Warehouses

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R. H. Wellman (left), Carbide and Carbon Chemicals Div., who spoke on the economics of fungicides, and S. E. A. McCallan, Boyce Thompson Institute, who spoke on testing techniques.

FUNGUS FIGHTERS

Agricultural chemists discuss newer fungicides at Philadelphia symposium.

The Division of Agricultural and Food Chemistry, American Chemical Society, met at the Philadelphia session. At one of the symposiums newer developments in fungicides were discussed. R. H. Wellman opened the meeting with a paper on the economics of fungicides.

According to Wellman, fungus diseases cost every person in the United States one dollar per month, in spite of the best control measures now available. He urged the development of better controls of fungi to reduce crop losses and force down food prices.

R. H. Gruenhagen, Dow Chemical Co., who delivered a paper on phenolics.

Fred R. Whaley (l.), Linde Air Products Co., and G. L. McNew, Boyce Thompson Institute. Whaley discussed chromate complexes as fungicides and McNew, the fungitoxicity of quinones.

Wendell H. Tisdale, E. I. du Pont de Nemours and Co., presenting a paper on the derivatives of dithiocarbamic acid as fungicides.

James G. Horsfall, of the Connecticut Agricultural Experiment Station, discussing fungitoxicity of heterocyclic nitrogen compounds.

Briefs

From recent literature

Pour depressants for waxy lubricating oils are prepared by treating an aliphatic substituted hydroxy aromatic compound of formula R_nArOH with an acylating agent (i.e. sebacic acid chloride) in the presence of a Friedel-Craft catalyst. R is preferably an alkyl group of less than 12 carbon atoms and n is 1 or 2. Two percent of the alkyl phenol derivative depresses pour point of waxy oil from 30° F. to −5° F.

Trialkyl phenyl phosphates of improved characteristics have been prepared by reacting alkyl phenols obtained from petroleum with phosphorus oxychloride at a temperature of 140°C.

Such products have greater electrical resistance, higher viscosities, lower toxicities and lower density than phosphoric acid esters made from other alkyl phenols.

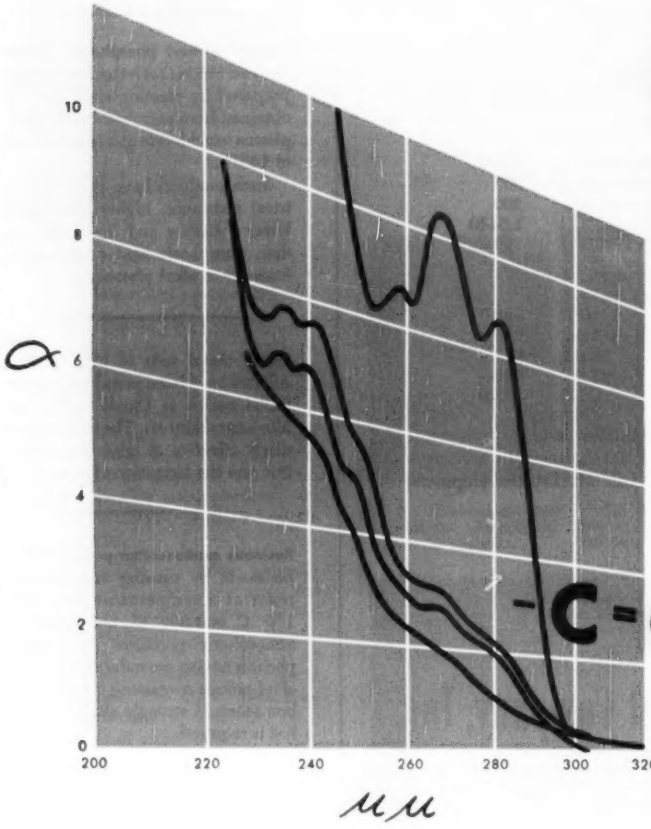
Heavy metal salts of alkyl phenol sulfides have been prepared and are found useful as Diesel crank case lubricant additives. They are particularly effective in inhibiting oxidation and the formation of gums.

Resinous condensation products may be made by causing acetylene to react at a temperature between 150° C. and 300° C., and at superatmospheric pressures with alkyl phenols having secondary or tertiary alkyl groups containing 3 to 12 carbon atoms. A strongly alkaline catalyst is required.

These developments are abstracted from recent publications or U. S. patents. The uses may suggest other applications of Jefferson Alkyl Phenol C-9 in your products or processes.

PROBLEM...

. . . to help varnish makers get the most out of tung oil. Although in short supply, tung oil is still preferred for many top-quality coatings because of its excellent drying properties . . . even though tung oil is a difficult material to cook.



Ultraviolet absorption curves show remaining triene in gasproof tung oil varnishes made with B-25 Resin.

SOLUTION...

. . . a new Hercules synthetic, B-25 Resin. When tung oil is cooked with B-25 Resin, processing headaches disappear. Varnishes entirely free from frosting, wrinkling, or checking are easily prepared. And this "gasproofness" can be obtained regardless of whether varnish making schedules call for long cooking periods at low temperatures, or fast cooks at moderately high heat.

-C=C-C=C-C=C-

HERCULES SYNTHETIC RESINS · CELLULOSE PRODUCTS · TERPENE CHEMICALS

MEET "SMOKEY JOE"! That's what Hercules' paint chemists call the test panel drying oven shown at left. Fed by an open gas flame, and cooled to room temperatures, it traps harmful fumes and soot. Only the most gasproof varnishes made with conjugated oils survive this test.

B-25 Resin is Hercules newest in a series of more than 50 resins that are helping manufacturers of protective coatings do a *better* job—another product of Hercules constant research in rosin and resin chemistry.

We would like to tell you more about B-25 Resin and the many other Hercules chemical materials that are serving industry, and to work with you toward a solution to your product processing or finishing problems.

HERCULES POWDER COMPANY *992 Market Street, Wilmington 99, Del.*
Sales offices in principal cities

RESULT...

. . . easy-to-make gasproof tung oil finishes that are popular with consumers because they have tung's well-known quick-dry, toughness, adhesion, and resistance to weathering. The limited supply of tung oil can now be used to maximum advantage.

Cuts Materials Costs

Hercules Vinsol® is a low-cost quality resin—currently 3¢-3.5¢ lb. Thermoplastic, dark-colored, high-melting, versatile "Vinsol" can be used to extend or modify many costlier resins and other materials—often with noticeable improvement in end-product performance. Known uses include asphalt emulsions, adhesives, plastics, protective coatings, printing inks.

For Better Detergents

Hercules materials combine to cut costs and improve performance of synthetic detergents. The addition of sodium carboxymethylcellulose (Hercules® CMC) and new rosin-derived nonionic surface-active agents provide detergents which can be used to wash cotton and other fabrics in hard or soft water over a wide range of temperatures.

New Idea in Defoamers

Now you can buy a defoamer in easy-to-handle, easy-to-use 2½-lb. bricks. This new, low-cost "Defoamer 4" eliminates waste, mess, and drums. One 2½-lb. brick, dissolved in water, makes 40 gallons of defoamer liquid. Send for free sample brick.

Is Abitol® the Answer?

"Abitol", Hercules hydroabietyl alcohol, is a colorless, tacky, viscous liquid at room temperature. It is a low-cost, high molecular weight resin alcohol. "Abitol" may be easily reacted, and possesses good stability. "Abitol" has already found application as a raw material for the manufacture of adhesives, alkyds, and oil additives. Its unusual combination of properties suggests an expanding variety of applications.

Typical Analysis:

Per Cent Hydroabietyl Alcohol	85-87%
Acid Number	0.1-0.4
Softening Point (Hercules Drop Method)	33°C.
Specific Gravity at 20°/20°C.	1.007-1.008
Refractive Index at 20°C.	1.528
Flash Point (Cleveland Open Cup)	185-195°C.

"VINSOL," "HERCULES," AND "ABITOL" ARE HERCULES TRADE-MARKS

ROSIN AND ROSIN DERIVATIVES · CHLORINATED PRODUCTS · AND OTHER CHEMICAL MATERIALS FOR INDUSTRY

GC50-3

CHEMICAL SPECIALTIES

Silver and Aluminum Polishes

by CORNELIA T. SNELL
Foster D. Snell, Inc., New York, N. Y.

A STANDARD HOUSEHOLD SPECIALTY, silver polish is based on mild abrasives and soap. Aluminum polishes are similarly formulated.

SILVERWARE—both plate and sterling—continues to hold its honored place in the American home, and this makes silver polish a "must." For silver must be polished frequently to retain its beauty since it quickly tarnishes when exposed to the atmosphere.

This steady demand for silver polishing compounds makes them attractive products for specialties manufacturers. They may be prepared as pastes, liquids or powders, or used to impregnate cloths for polishing. The same or similar formulations can be used to polish aluminumware.

Well formulated silver polish contains two basic ingredients: an abrasive and a cleanser, usually soap. As noted in a previous article, "Metal Polish Formulations,"[1] silver is a very soft metal, slightly softer than gold. When silver tarnishes, it acquires a very adherent film of dark silver sulfide which can be removed only by the mechanical action of an abrasive powder. This abrasive must be just hard enough to polish but not hard enough to scratch the soft silver surface.

Soap plays an important function because of its surface activity. It wets the silver surface preferentially and aids in the removal and dispersion of the silver sulfide which has been loosened mechanically.

The effect of an abrasive powder depends on a combination of three factors—hardness, particle size, and particle shape. For polishing silver, the most suitable abrasive is diatomaceous earth, sometimes called infusorial earth or by the British name, whiting, also by the German name kieselguhr. Diatomaceous earth has just the proper degree of hardness, or rather softness, for polishing silver; it is extremely fine; and it is amorphous rather than crystalline, hence is non-scratching. This combination makes it the ideal abrasive for the purpose. It is very light and fluffy, with a specific gravity of about 2.70. As ordinarily used, and as required to meet Federal specifications for silver polish, it must be sufficiently fine to pass 100 per cent through a standard No. 200 sieve.

PASTE TYPES POPULAR

The amount of soap may vary from 5 to 15 per cent, the amount of abrasive from 10 to 30 per cent in a paste polish. In both paste and liquid products, the soap serves to disperse the abrasive in the liquid phase, as well as to act as cleaning agent during the polishing process. Paste products are extremely popular. Examples of basic paste formulas which can be varied according to the compounder's individual ideas are as follows:

		%
(1)	Tallow chip soap	5
	Sodium metasilicate	2
	Soda ash	3
	Diatomaceous earth	20
	Water	70

		%
(2)	Tallow chip soap	13
	Soda ash	1
	Sodium silicate, $Na_2O:3.25SiO_2$	1
	Diatomaceous earth	30
	Glycerine	10
	Water	45

These may be prepared by stirring the soap and alkaline salts with the water, then sifting in the diatomaceous earth gradually with continued stirring. Where glycerine is used in formulating a product, it is mixed with water at the start. The presence of alkaline salts increases the cleaning action by increasing its alkalinity and by serving as a soap builder. An alkaline salt increases the detergent efficiency of soap. The combination of soap and "alkali" is always used in the commercial laundry. The same principle applies here as regards cleaning efficiency. Sodium silicate, particularly the more siliceous silicate, besides being a soap builder has some action in promoting dispersing power.

The Gorham Co.

PASTE POLISHES for silver have the advantage of remaining homogeneous, are very popular.

Paste polishes may be perfumed with such agents as pine oil, oil of sassafras, methyl salicylate, cedar-leaf oil, or inexpensive blended perfume materials. Many silver polishes contain a small amount of pink dye, no doubt because some of the successful leaders in the field set the style by their pink color. Anyone who wishes to be different may use yellow, blue, or some other dye of his own choice. The so-called jewellers' rouge does not give the clear bright pink color desired in present-day products, so that this pigment is seldom used in household polishes. It would be rather dull and brownish-pink.

Since glycerine is hygroscopic, it

may be incorporated to help keep the product from drying out after the jar has been opened. Acids and cyanides are prohibited in silver polishes meeting Federal specifications. Acids are incompatible with soap. Cyanides, which possess chemical cleaning action because of forming a complex with silver ion, are objectionable because of their marked toxicity.

LIQUID TYPES ARE CONVENIENT

Liquid products are also popular and possibly even more convenient to use than paste polishes, provided the liquid is sufficiently thick not to drip from the article being polished. One difficulty sometimes encountered with the liquids is that the powdered material tends to settle out as a hard cake in the bottom of the container. When the cake becomes really hard it cannot be redispersed by shaking. Making the original dispersion fairly thick tends to prevent such settling. Paste polishes have the advantage of retaining their homogeneity. Examples of formulas for liquid silver polish are as follows:

	%
(1) Diatomaceous earth	20
Tallow Chip Soap	6
Ammonia (0.880)	2
Water	72

	%
(2) Red oil	4.5
Ammonia (26° Be)	2.7
Glycerine	5.0
Diatomaceous earth	15.0
Bentonite	1.0
Potash	0.5
Water	71.3

The first formula is prepared by simply mixing the ingredients, the ammonia and soap being added to the water first. In the second formula, soap is made by the reaction of red oil (oleic acid) and ammonia. The red oil is added with stirring to the ammonia dissolved in part of the water. The rest of the water, glycerine, and potash are added. The powdered ingredients are finally sifted in, with stirring.

Bentonite is a powder which has no polishing action but which serves to thicken the product and promote dispersion of the abrasive. Odorants and dyes may be added to these products the same as to the pastes. The abrasive should be 200 mesh, that is, of the same degree of fineness as that used in the pastes.

No attempt will be made to cover silver-polish patents, for many products described in patents never become commercial and are of little importance. The following is mentioned to illustrate a polish containing alcohol.[2]

	%
Low molecular-weight alcohol	15-50
Gum tragacanth	0.5-2
White mineral oil	1-5
Diatomaceous earth	5-25
Water	balance

In making such a product the gum is allowed to swell in the water, which is then mixed with the other liquid ingredients; the abrasive is sifted in at the end. In this the gum tragacanth is the emulsifying agent. Soap could also be used if desired in order to make a more stable emulsion. Another thickening agent used in a similar patented product[3] is polyisobutylene.

SILVER-POLISH CLOTHS

Silver-polishing cloths continue to enjoy moderate sales. Their major defect is that they quickly become soiled by the tarnish rubbed off on them so that they are no longer sightly or pleasant to handle. After impregnation the cloths may be attached to a suitable non-impregnated piece to make them more convenient in use. Such cloths are suitable for removing a very light film of tarnish, so that many house wives keep both the polishing cloth, and the paste or liquid silver polish on hand.

Polishing cloths may be prepared by dispersing a suitable mixture of tallow soap and diatomaceous earth, say in a proportion of 1:1, in kerosene. Excess kerosene is squeezed out and most of the balance is allowed to evaporate so that the cloth will be only slightly oily when ready for use.

Cloths have also been prepared by impregnating them with powdered mixtures of abrasive and alkaline salt in a solution of soap, algin, or methyl cellulose,[4] often with a small addition of glycerine to retain moisture. The cloths may be dipped two or three times, with drying in between. They are wet with water for use.

Formulas for powdered mixtures may be found in the literature but actually the powders are not popular because they are less convenient to use.

ALUMINUM POLISHES

Aluminum is a soft metal having practically the same hardness as gold. However, aluminum is quite reactive and soon forms a grayish film of aluminum oxide which is somewhat harder than the aluminum beneath and which serves as a protective coating. Since aluminum is used for cooking utensils, the main object is to keep it clean and not necessarily as highly polished as silverware.

As with silver, brass polish is much

too harsh for use on aluminum. Merely for purposes of cleaning, soaped pads of steel wool are most satisfactory. They furnish the required mechanical action without an undue amount of scatching. Strong alkalis such as soda ash and trisodium phosphate must be avoided in cleaning aluminum because they attack and corrode the metal.

Silver polishes are suitable for use on aluminum, or the following may be made up for the purpose:

		%
(1)	Potash soap	10
	Diatomaceous earth	50
	Water	30
		%
(2)	Ammonium stearate	5
	Stearic acid	5
	Naphtha	40
	Air-floated tripoli	50

As may be seen, the ingredients in the first formula are no different from those of the usual silver polish. The second has some resemblance to superfatted soap such as is added to dry cleaning fluids. However an abrasive is also present, which, of course, is absent in the drycleaning fluid. Supposedly the excess stearic acid would leave a film on the aluminum to give it more gloss and depth of color. Air-floated tripoli is a very finely divided powder made from decomposed limestone. It is slightly harder than diatomaceous earth but not as hard as silica. It should be suitable for use on ordinary aluminum utensils, which are necessarily coated with the oxide.

In conclusion, the principal thing to remember in making any metal polish is to select the abrasive suited to the particular metal being cleaned. This is particularly emphasized in formulations for use on soft metals like silver and aluminum.

The question may arise as to whether soap could be replaced by a synthetic detergent as dispersing and cleaning agent in these polish formulations. It could be, but there is no advantage in doing this. Soap is less expensive in terms of active ingredient and is more efficient in this application. Soap is far more effective in dispersing solid particles than is any synthetic detergent which the author has studied to date. In the controversy between soap and synthetics, soap is still the first choice under certain conditions of use.

REFERENCES

1. Cornelia T. Snell, *Chemical Industries*, 52, 742-6; 1949.
2. Delbert F. Brown & Hugh C. De Hoff, U. S. Pat. No. 2,205,115; 1938.
3. Standard Oil Development Co., French Pat. No. 845,219; 1939.
4. W. D. John, *Modern Domestic and Industrial Polishes and Specialties*, p. 266. R. H. Johns, Ltd., Newport, England.

DRYMET*

THE ECONOMICAL DETERGENT SILICATE

Cowles DRYMET, anhydrous sodium metasilicate, is the most highly concentrated form of sodium metasilicate available. It is more economical to use, on the basis of both Na_2O (alkalinity) and SiO_2 (silicate) than any other type of hydrated or anhydrous detergent silicate, either compounded or by itself. DRYMET contains no water of crystallization.

DRYSEQ*

THE ALL-PURPOSE DETERGENT SILICATE

Cowles DRYSEQ, anhydrous sodium sesquisilicate, is a medium pH alkaline cleaner which will do fast, dependable work at a low cost to the user. It is a white, free-flowing powder, quickly and completely soluble in hot or cold water—containing 56.75% Na_2O—making it an economical base material for compounding.

Cowles CHEMICALS

DRYORTH*

THE HEAVY-DUTY DETERGENT SILICATE

Cowles DRYORTH, anhydrous sodium orthosilicate, is a powerful, speedy, heavy-duty cleaner with valuable penetrating and wetting-out properties, reinforced dirt-removing power and unusual emulsifying action. It is an anhydrous, free-flowing powdered silicate containing not less than 60% Na_2O, which may also be used as an economical constituent of high pH cleaning compounds.

CRYSTAMET*

THE MEDIUM pH DETERGENT SILICATE

Cowles CRYSTAMET is a pure, perfectly white, free-flowing granular pentahydrate sodium metasilicate with the normal 42% water of crystallization. Suggested for compounding when it is desirable to lower the concentration of a finished product. Readily soluble—chemically stable—easy to handle. Can be used on medium pH jobs.

★ PROMPT SHIPMENTS FROM CONVENIENT WAREHOUSE STOCKS . . .

We'll be glad to send you our DRYMET File Folder containing complete technical information and suggested formulations.

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COWLES CHEMICAL COMPANY

HEAVY CHEMICALS DEPARTMENT • CLEVELAND 3, OHIO

RETAIL STORE appearance of service station marks a sales trend.

Service Stations— Growing Specialty Outlets

GASOLINE STATIONS stress accessory store character, move more automotive and miscellaneous specialties.

EVERY manufacturer of an automobile specialty dreams of selling it through one of the large oil companies just as a retailer of souvenir novelties hopes for a store on New York's Times Square. It's not hard to see why, for the oil companies are the best pipeline to the nation's gasoline service stations at which some thirty-five million passenger cars and seven million trucks stop regularly.

Although the bulk of motorists' purchases are gasoline and oil, for every dollar so spent an additional few cents go for some item of car maintenance, including a wide variety of automotive chemical specialties, or for some product not connected with cars at all. The present trend is for a greater proportion of so-called TBA (tires, batteries and accessories, which includes chemical specialties) sales to be made by service stations, and oil companies emphasize that with one stop the motorist can buy everything he needs for his car. Esso Standard Oil Co., for example, is currently conducting an advertising campaign stressing the retail-store character of stations operated by 25,000 Esso dealers. For their own part, the independent merchants running the stations are anxious to add any product offering additional revenue.

Opinion has been somewhat divided on the value of service stations as outlets for products other than the staples—gas, oil, water and air. Gas stations, for the greater part, have been outside installations for gassing, greasing, and car washing, with a small shanty to protect the attendant. This has obviated the possibility of carrying a large inventory, or of having much "store" in which to display such things as tires, seat covers, auto polish, radiator flush, anti-freeze, etc. The motorist doesn't usually leave his car and he spends but a few minutes in the station. Quality of salesmanship, which should be high to cope with such natural obstacles, has been often the subject of jokes, although not always with justification.

GROWTH OF SALES

Since the war much of this has changed, and this is borne out by TBA sales through service stations. These have grown steadily since 1929 with the greatest gain over the past three years, and this year sales are expected to represent $575,494,000 out of a total volume of $1,880,701,000 sold


"Shipped on schedule"
That's almost routine notification for customers who order Coal Chemicals from United States Steel. Our careful attention to delivery dates, backed by the production of nine strategically-located plants, has saved customers countless "late-delivery" headaches, as well as heavy demurrage charges.
In regular shipments of two or three cars per month to one large customer, for example, records show only one unfilled shipping date in more than five years.
Benzol, Toluol, Xylol, Phenol, Cresol, Cresylic Acid, Naphthalene, Creosote Oil, Pyridine, Picolines and Ammonium Sulphate—all these Coal Chemicals are produced by United States Steel. For prompt service, contact the nearest of our five sales offices.
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USS
COAL CHEMICALS
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through all outlets.* Tires have been the leader in this gain, and the figures include such things as batteries, fog lights, seat covers, etc., but chemical specialties, too, have shown a proportional increase. An idea of the size of the market can be gleaned from this year's potential service station sales of polishes and waxes, radiator chemicals, and polish cloths which are estimated at $24.3 million, $24.3 million and $3.6 million respectively.*

Part of the reason for improvement in stations as distribution points has been the necessity for the owner to seek sources of profit other than gasoline, for the gallonage sold per station has not increased sufficiently to keep up with higher costs for building, taxes, and labor. Right after the war, many operators pushed polish, touch-up paint, window cleaner, and the like; added items new to gas stations.

Oil companies, whose profit is tied to the success of these outlets they supply, aided these efforts by building stations with larger buildings for storage and display counters (major oil companies commonly lease stations to independent operators or establish them through other financing plans), and by helping in merchandising training. Today most oil companies are striving to improve selling techniques by such devices as sales clinics conducted for their dealers' benefit and by making available suitable display racks and other sales helps at cost. Atlas Supply Co., which sells Esso Standard all the non-petroleum based accessories it distributes to its dealers, for example, makes a model display window each month, and sends pictures of it to Esso stations as a guide.

In the immediate postwar effort to expand lines, some of the larger stations even went so far as to handle such things as electrical appliances, but in general owners have restricted themselves to products that have some logical connection with their type of business. Few stations will have a complete line, but all of the following strictly automotive products will be sold: radiator anti-freeze, cleaner, sealer, rust inhibitor; sealer for cracked blocks, etc.; water absorbent for gasoline to prevent freezing; wax cleaners and polishes of different types; metal polish for chrome; rubbing compound; windshield cleaner; windshield sealer; car wash; tire dressing; tire cleaners; top dressing; touch-up paint; car paint; upholstery cleaner; hydraulic brake fluid; dry cleaning fluid; hand soap. Among the non-car specialties sold are such items as lighter fluid, handy oil, insecticides, furniture polish, floor wax, glass cleaner, home dry cleaning materials.

Generally the oil companies manufacture the petroleum-based specialties and have those that do not fit into their raw materials picture manufactured for them under their label. This does not mean that they will not handle specialties for which there may be a national preference. Such things as PiB, U. S. Industrial Chemicals, Inc.'s insulating liquid for automotive ignition systems or Johnson's and Simoniz's waxes may be found in any station. The oil company may have it in its line, or the dealer may have purchased it from an automotive jobber or tire distributor.

Where the oil company purchases private label specialties, its TBA department or retail department sets up specifications, and contracts are let to specialty manufacturers. If a specialty manufacturer has a new product that he feels may fit into service station merchandising, or a better type than one on the market, these are the people to see. As with most private label business, the manufacturer may have to set a lower price than he would normally, but the volume of sales that he can obtain in this way without advertising, and the simplificaton in bookkeeping and distribution that results, will probably mean higher overall profits.

PACKAGING

Packaging is an important consideration in service station sales. The package must be of the proper size to deliver enough material for a given operation, such as a radiator flush, and should be one that is easily displayed on a counter or in a rack. Most of the sales are made in connection with some service that the driver orders or is suggested by the attendant, but well-designed containers can be a potent force in selling. This is particularly true of an item like the can of handy oil or the aerosol insecticide a motorist may pick up while waiting for a flat to be changed.

In the above discussion of service stations as retail outlets, emphasis has been placed on major oil companies' role in the distribution pattern although petroleum jobbers, tire manufacturers, independent TBA dealers and automotive jobbers are important. The specialty manufacturer will want to investigate these other factors on the wholesale level, for the more stations he can get his products in, the greater advantage he can take of their trend toward increased sales of accessories.

* Switzer, George L., "What Sells in Service Stations—When—Why and How Often," Tire, Battery & Accessory News, April, 1950.

SPECIALTIES NEWS

Form New Company for Textile Chemicals

The Mac Chemical Co. has been formed in Knoxville, Tenn., by William S. and Jack McNab to manufacture and sell a line of textile chemicals for dyeing, bleaching and finishing. The new organization, whose principals have been with O. F. Zurn Co., Philadelphia, has just begun operating its new plant in Knoxville. This is a modern structure with 8,000 sq. ft. of floor space; all equipment for compounding and sulfonating is stainless steel and is individually motor driven.

In addition to compounding textile chemicals such as dye penetrants, detergents, softeners, and synthetic resin fillers, the company is a textile soap distributor for the Colgate-Palmolive-Peet Co. and distributor of Becco Liquid Peroxide for Becco Sales Corp., Buffalo, N. Y.

Develops Novel Formulas For Antihistamines

People chewing gum, eating chocolate, or drinking an effervescent mixture while minimizing the effects of the common cold is in prospect as a result of newly developed formulations containing antihistamines. The Pharmaceutical Research & Development Co., Brooklyn 23, N. Y., has developed and has patents pending on antihistaminic chewing gum, effervescent granules and tablets, lozenges and chocolated antihistamines.

The company was formed recently for the commercial development of new pharmaceutical products.

Canada To Use Aldrin Against Grasshoppers

This year the three great agricultural provinces of Canada—Alberta, Manitoba and Saskatchewan—have chosen Aldrin (Compound 118) to control grasshoppers and protect several million acres of wheat and other crops from destruction by these pests. The Canadians are using this chemical in dosages of 2 ounces (⅛ pound) to 4 ounces (¼ pound) per acre in spray or dust to obtain almost complete control of 'hoppers 24 hours after application.

Although Aldrin has been approved by the U.S.D.A. for cotton insect control, approval for grasshopper control in the United States has not yet been granted.

G. C. Walters ((left), director of sales research and promotion of the J. I. Halcomb Mfg. Co., Indianapolis, who has just been added to the board of directors; and Donald S. Cushman, formerly assistant to the president of Innis, Speiden & Co., who has been appointed vice-president in charge of sales.

"What's New" Memo

Do you make heat-sealing adhesives? Automotive specialties? Textile specialties?

You'll want to read these articles in this issue:

U. S. Rubber Opens New Textile Laboratory

A new $250,000 textile research and development laboratory has been opened by United States Rubber Co. at Winnsboro, S. C. Opening of the laboratory brings together a staff of more than 25 research men and women in a consolidation move designed to improve and expand the company's textile operations. Practically all the company's textile research and development work will now take place at Winnsboro except research on asbestos products, which will continue at Hogansville, Ga., home of the company's Asbeston plant.

Pilot plant facilities to serve all mills of the textile division have been installed in the laboratory. These facilities, which include equipment for spinning, twisting and weaving, are located in a large processing area designed for work on special yarn and fabric projects.

Washington Firms Combine

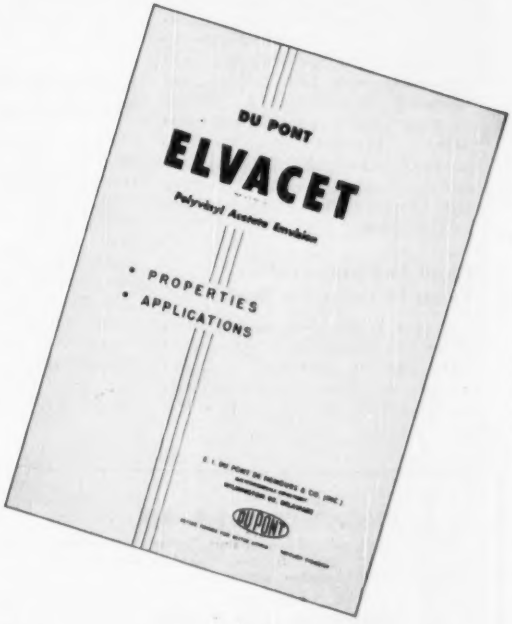
As part of a concerted expansion program, the research, engineering and marketing facilities of Kilgore Chemicals, Inc., and Atlantic Research Corp., Alexandria, Va., have been

YOU need this information about low-cost resin emulsions

SEE

why versatile "Elvacet" polyvinyl acetate emulsion has solved many important problems . . .

how it can lead to a saving in your operations . . . an improvement in your product . . . or to the development of an entirely new and profitable item.



READ

why this colorless, odorless, film-forming resin can be used to make—

★ Grease-proof coatings on paper and other materials . . . or grease-resistant sizes.

★ Textile finishes: Fabric stiffeners, coatings, laminations, hat sizes.

★ Adhesives and binders for: Cellophane, paper, cardboard, cloth, felt, straw, wood, cork, leather, metal, metal foil, mica, inorganic fillers, ceramics, pigments, asbestos.

★ Specialty compounds with starches, dextrins, gums, waxes, many synthetic resins, chlorinated rubber, rubber latex and other common types of extenders, pigments and plasticizers.

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Electrochemicals Dept., Wilmington 98, Del.

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merged. Mechanics of the move call for establishment, within the structure of the Atlantic Research Corp., of a Kilgore Chemicals Division, headed by Anthony Hass, formerly general manager of the Kilgore Co. Activity of the new division will be directed toward expanded development, manufacture, and sale of specialty chemicals in the insecticide, fungicide, and industrial deodorant fields.

First major operation of the new division will be establishment of distributorships on a nation-wide scale for Odorex, aerosol-type industrial deodorizer containing the Kilgore-patented ingredient Metazene, an odorless chemical that destroys objectionable odors by chemical action. Metazene formulations for specific industrial odor problems also will be manufactured and sold through ARC's Kilgore Chemicals Division.

Plant to Produce Wax From Douglas Fir Bark

Oregon Wood Chemical Co., lessee of the Government alcohol-from-wood waste plant at Springfield, Ore., will produce wax from Douglas fir bark, according to a report in the **Raw Materials Survey Newsletter** for Feb.-Mar., 1950. A recovery process developed at the Oregon Forest Products Laboratory at Corvallis will be used. The wax is obtained by steam distillation of benzene which has been used to dissolve the wax from the ground bark.

Production of 3 tons per day is planned. In addition, another Forest Products Laboratory development, tannin from Douglas fir bark, will be given a production trial at the same plant in the near future.

Consolidated Royal Erects New Building

Offices and manufacturing facilities for Consolidated Royal Chemical Corp., now being completed at 657 West Chicago Ave., Chicago, will double its present production capacity. The company manufactures Krank's shave cream, Mar-o-Oil shampoo, Kolor-Bak, Peruna, Zymole Trokeys and other drug products.

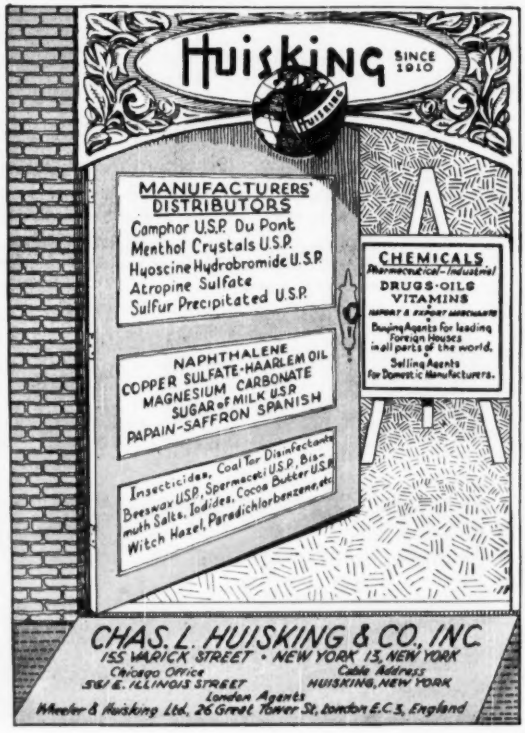
The new one-story structure will occupy 88,000 square feet, cost $500,000. Edward Steinborn, Inc., is the architect. New manufacturing equipment worth $75,000 will be installed.

Ala. Insecticide Plant Under Construction

Construction of a new insecticide manufacturing plant for the Tobacco By-Products and Chemical Corp., Richmond, Va., is underway in Montgomery, Ala. The plant will specialize in the production of insecticides for cotton, peanut, vegetable and fruit crops of the South. Production is scheduled for an early date. Location of the plant is on property of the parent company, Virginia-Carolina Chemical Corp.

Detergent Group Lists C.S.M.A. Schedule

The Soap and Detergent Section of the Chemical Specialty Manufacturers' Assn., which meets June 11-13 at the Drake Hotel in Chicago, announces the following schedule: Sunday, June 11, at 6:30 P.M.—supper meeting; Monday, June 12, at 2:30 P.M.—round table discussion and symposium on fatty acids; Tuesday, June 13, at 9:15 A.M.—technical session with papers on foam measurement, optical bleaches in soaps and detergents, evaluation of paint and linoleum cleaners, sulfonation of alkyl aryls, and recent developments in non-



ionic surface active agents; and at 3:00 P.M.—business meeting.

Du Pont Opens Collection Of Foreign Fabrics

A collection of over 100,000 foreign fabrics of natural and synthetic fibers is being made available by the Du Pont Co. to the textile trade. Gathered over a period of nearly twenty-five years by the Fabric Development Section of the Rayon Division, this group is believed to be the largest assembly of fabric samples in this country. Cataloguing has just been completed, with eight broad divisions and fifty-nine subdivisions.

The collection is intended primarily for use by mills and converters, to serve Du Pont customers and the textile market as a whole. Fabrics are chiefly from European sources and include also important representation from China, Japan, South America, and other parts of the world. Many of the fabrics have been manufactured and sold commercially.

This collection may be seen by appointment with the Fabric Development Section of the Rayon Division, Du Pont Co., Empire State Building, New York, N. Y.

Charles P. Fernald (left), formerly export manager of the Verney Corp., appointed assistant export manager in charge of international sales of John Powell & Co., Inc.; and A. H. Carpenter, new eastern sales manager of the agricultural chemical division of Mathieson Chemical Corp. Mr. Carpenter formerly was with Baugh & Sons Co.

Monsanto Establishes Food Technology Lab

A food technology laboratory to investigate the application of chemicals in the food industry has been established at Anniston, Ala., by Monsanto Chemical Co. It is one of a few such laboratories in the chemical industry.

The laboratory, which includes the leavening research previously conducted by the company's Phosphate Division, will serve Monsanto's six operating divisions on problems related to food and food processing. It will also act as liaison with the food industry and with university and government laboratories.

Plant Regulators Produce Larger Fruit

Bigger and better fruit may be on the way, if experiments with plant regulators are successful.

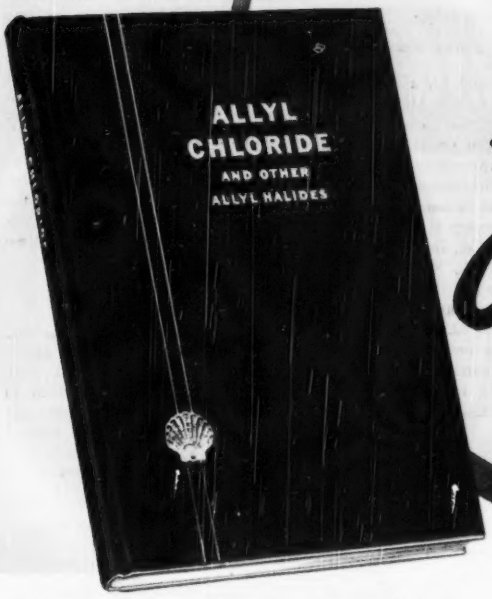
In preliminary work last summer, plant scientists of the University of California produced lemons two and three times larger than normal. They did it by spraying the trees with tiny amounts of 2,4,5-trichlorophenoxyacetic acid.

The California scientists, warning that proper dosage and timing are important, reported that about three tablespoons of 2,4,5-T in 500 gallons of water increased the rate of lemon growth when sprayed on the trees. It also delayed yellowing of lemons on the tree and in storage, and prevented ripe lemons from dropping.

Researchers feel that the use of growth regulators can revolutionize fruit production. Some possibilities: larger fruit, controlled ripening to meet varying demands, and prevention of dropping until fruit can be picked.

Now Available...

A New Book From Shell Chemical



ALLYL CHLORIDE

$CH_2=CH-CH_2Cl$

A complete summary of known properties and uses for this highly reactive intermediate

ALLYL CHLORIDE, the key to Shell's synthetic glycerine production, offers equally important opportunities for syntheses along other lines —resins, dyestuffs and pharmaceuticals, for example.

This new book contains information never before released, including a comprehensive review of available literature and data compiled by the Shell Development research staff.

Allyl Chloride is highly reactive, forming a wide variety of compounds by addition to the olefinic bond. It also exhibits all of the characteristics of organic halides. Both the double bond and the chlorine atom may react simultaneously or in successive operations.

Send your letterhead request for a copy of this new book and investigate reactions of Allyl Chloride that offer promise to you.

ALLYL CHLORIDE is available in TANK CARS and DRUMS

Shell Chemical's plant in Houston, Texas, is in commercial production of this intermediate. You can be sure of an adequate and continuing supply. Samples for your evaluation will be furnished upon request.

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Company Notes

• **Lever Bros. Co.** has completed a new manufacturing plant at Edgewater, N. J., for the production of No-Rinse Surf. Capacity of the new unit is about a quarter of a million packages per day.

• **Arnold, Hoffman & Co., Inc.,** Providence, R. I., has selected National Starch Products, Inc., New York City, to manufacture and sell its present line of dextrines to the textile industry. There will be close association between the technical staffs of both companies.

• **Allethrin,** a new non-toxic insecticide material (*C.I., April 1950, p. 506*) will be made available shortly in limited commercial quantities, from John Powell & Co., Inc., New York.

Allethrin promises to be a boon to aerosol bomb manufacturers, since it is more soluble than natural pyrethrum in freon and other types of aerosol bomb propellents.

• **Dura Chemical Co.,** broker and import representative specializing in waxes, gums, and essential oils, has moved its offices to larger quarters at 20 Vesey Street, New York, N. Y.

NEW CHEMICAL SPECIALTIES

Note: This section limited to new finished specialties. New raw materials and intermediates of interest to specialties manufacturers are described in New Products and Processes department.

Rat and Mouse Killer

Powder containing new rodenticide in commercial tests.

W.A.R.F. Compound 42, a new rodenticide developed by the Alumni Research Foundation of the University of Wisconsin and placed on the market under experimental permit of the U. S. Department of Agriculture last fall, is proving successful in commercial tests, according to a summary report issued by R. J. Prentiss & Co., Inc., 110 William Street, New York, N. Y., manufacturer and distributor of Rax, a rat and mouse killer containing the new W.A.R.F. Compound 42.

The report points out that the experimental permit restricts the use of the new rodenticide to pest control operators, public health officials, sanitary engineers and Fish & Wildlife personnel. Since they must file reports of their experience with Rax, it is possible to keep an accurate check on results. With Rax, practically complete control of the Brown (or Norway) Rat, Alexandria (Roof or Black Rat), and mice has been accomplished.

The experimental sales program, which Prentiss is handling, now is being expanded to make Rax powder, containing W.A.R.F. Compound 42, available at the farm use level to determine if the untrained individual can use it successfully. Arrangements have been made for its distribution at the farm level in Illinois, Missouri, New Jersey and Connecticut to date. It has been used successfully in several foreign countries, as well.

Rax powder is available for repackaging under private label from Prentiss. It is sold in small packages for the farm experimental program by Motomco, Inc., 10 Murray Street, New York, N. Y.

Aircraft Polish

Aluminum surface polish for aircraft is designed to meet navy specs.

Fine Organics, Inc., 211 E. 19th St., New York, N. Y., has added to its line Stratoglo, an aluminum surface polish for aircraft. Formulated to meet navy specification P-69a performance, it is a homogeneous liquid

suspending polishing solids. It is either applied manually or used with mechanical buffing equipment. Advantages claimed for it are easy application and removal with a minimum of man hours.

Surfaces treated with Stratoglo are left with natural, bright finish. The polish is available in one, five, and 30 gal. containers.

Defoamer

Petroleum-based product is used in water-base paints.

The paint industry can now use S/V Foamrex X as a defoamant in water-base paints. Manufactured by Socony-Vacuum Oil Co., Inc., it has a petroleum product as its base.

Socony claims it permits use of emulsion equipment at full capacity. In addition, its defoaming action aids accurate measuring into packaging containers.

Liquid Fumigant

Soil and seed bed fumigant contains chlorpicrin as warning agent.

Innis, Speiden & Co., 117 Liberty St., New York, N. Y., is now producing a new Isco methyl bromide soil fumigant containing 2% of chlorpicrin as a warning agent. The fumigant, a liquid, is packed under pressure in 1 lb. tins and is released under a gas-tight cover fitted over the prepared soil where it is held for 24 hours or longer. The gas is effective on weed seeds, certain grasses, nematodes, grubs, wireworms and soil infecting insects in various stages of development.

Seed beds, as well as compost, manure and potting soils, are treated with a Jiffy applicator, the material being discharged through a tube connecting the applicator to a metal trough previously placed under the gas-tight cover.

General Purpose Adhesive

Quick penetrating adhesive is recommended for general industrial use.

Cezit Adhesive, product of Service Industries, Philadelphia, is said to have excellent holding power when extended with 10% to 100% water. It can be applied to only one surface in use for corrugated and solid fibre case sealing. Penetrating quickly through water repellent carton sizings, it dries rapidly. It does not become brittle although it bonds quickly and firmly, according to Service Industries. In addition it increases structural strength and rigidity of sealed cartons.

Further advantages, according to the manufacturer, are its non-toxic, fireproof and odorless qualities. It is also

P.S. Continental also makes steel containers in a wide variety of sizes for bulk shipments.

CONTINENTAL CAN COMPANY

100 East 42nd Street New York 17, New York

insect and rodent repellent. It is available in single gallons at $3.00, with price reductions for purchases of larger quantities.

Synthetic Enamel

Finish gives hardness of baked synthetic with fast air dry.

A new, fast-drying enamel said to reduce a manufacturer's finishing time by 40 per cent and cut his storage and handling requirements by 50 per cent, has been introduced by the United Lacquer Mfg. Corp., Linden, N. J. Known as Base Y 2054, the new synthetic protective coating provides the hardness of a baked-on synthetic, but air dries as fast as lacquer, in just a few minutes.

Base Y 2054 was designed particularly for plants which do not have baking facilities. By providing hard, highly-resistant top surface quickly, the new finish speeds up the manufacturing process for these plants and eliminates the need for a 24-hour air drying period. Products finished with the synthetic may be handled and stacked within 15 minutes and packed in three to four hours.

It is equally effective on wood, metal, or fiber products. It may be polished to a hard gloss and has good gloss and color retention, even under high humidity conditions.

Pre-Emergence Spray

Field-scale tests are being conducted on spray for large seeded crops.

A pre-emergence weed killer manufactured by The Dow Chemical Co. and known as Premerge is being tested this spring on cotton and other large seeded crops such as peanuts and corn. Dow claims promising experimental results, and tests on a field scale are being directed by state experiment stations as well as Dow's technical service and development division. The product will not be available commercially this year.

Premerge contains the amine salt of dinitro-*o*-*sec*-butylphenol and is a residual pre-emergence type weed killer. Germinating weed seedlings are killed or checked by the chemical for several weeks when it is applied to the soil immediately after planting.

Aluminum Coating

Tough coating protects surfaces exposed to abnormally high temperatures.

Service Industries, 2103 E. Somerset St., Philadelphia, is now producing Sil-Var 1000 High-Heat, an aluminum coating to protect metal surfaces that are constantly subjected to high temperatures, up to 1000° F. Having an

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In the past year, we've greatly improved the quality of Wyandotte Soda Ash. And we're building new equipment that will make it even better.

Take purity, for instance. Wyandotte Soda Ash is better than 99½% *pure* sodium carbonate.

The particle size of each grade is characteristically uniform, too. Screen it. You'll find what Wyandotte product control does for you. And count the grades of Wyandotte Soda Ash that are available. There's light ash and several grades of dense ash — each tailored to meet specific requirements. *All* of these grades conform with U.S.P. XIII standards of purity.

Don't forget shipping containers and facilities, either. We supply Wyandotte Soda Ash in packages or in bulk. We ship in boxcars, hopper cars, trucks or by ship.

And when you buy Wyandotte Soda Ash, you get something without price, Wyandotte Technical Service.

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CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE
HYDROGEN • DRY ICE • SYNTHETIC DETERGENTS • GLYCOLS
CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE • PROPYLENE
DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES
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Wyandotte
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organic resin polymer base, it is designed for application to lined and unlined steel stacks, flues, boiler fronts, Diesel engines, blast furnaces, and similarly heat-exposed surfaces. It comes ready mixed and is applied by brush, spray or dip; 300 to 350 sq. ft. are covered per gallon per coat.

Applied to surfaces not exceeding 100° F., it dries hard within 3-4 hours. Sil-Var is sold in 1 gal. cans at $6.50 and is also available in larger containers with lower prices for larger purchases.

Mildew Resistant Additive

Paints can be protected from mildew with fungicide-based additive.

Mildew, a prime cause of paint discoloration, can be combatted with Ad-It, product of Nuodex Products Co., Inc., Elizabeth, N. J. A liquid, it is added to paint in the proportion of an oz. a gal.; is easily mixed on the job, according to Nuodex. Permanence is claimed for the additive, as well as resistance to weather extremes.

It is packaged in 1 oz. and 5 oz. bottles for dealers. Paint manufacturers also use it formulating paints. The retail selling price is 67¢ per 1 oz. package, with proportionate adjustments for larger packages and multi-lot purchases.

Brazing Alloy

Silver alloy for brazing metals now comes in small packages.

Easy-Flo 45, a silver alloy for brazing ferrous, non-ferrous and dissimilar metals, is now available in 5-oz. packets. The newly packaged product of Air Reduction Co., Inc., will be added to the oxyacetylene welding line of its dealers and sales offices.

Each packet contains a coil of 1/16 in. wire (approximately 330 lineal in.), instructions for use, and a folder giving complete details about the product. According to the manufacturer, this new silver brazing package should find acceptance by repair and maintenance crews, in small shops and in shops doing experimental work.

Anti-Corrosive Primer

Corroded iron and steel can be pretreated without complete rust removal.

Tuf-On-Rust designates the anti-corrosive primer for corroded iron and steel developed by Brooklyn Varnish Mfg. Co., Inc., 50 Jay St., Brooklyn, N. Y. It is recommended for pre-treating ferrous metals in cases where complete removal of foreign matter such as rust is not possible.

Four hours is the approximate recoating time required, so that exten-

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As one of the leading producers of Chlorobenzenes, Hooker offers many advantages to you. Rigid processing standards assure you of uniformly high quality products. Ample manufacturing facilities assure prompt deliveries to meet your most exacting production schedules. As specialists we have a wide fund of technical knowledge of uses and applications that many purchasers have found most helpful. We invite you to test Hooker Chlorobenzenes. Please request samples and literature on your business letterhead.

ORTHODICHLOROBENZENE — $C_6H_4Cl_2$

Tech. (1,2-dichlorobenzene)

DESCRIPTION:
Clear, colorless liquid with characteristic odor. Completely miscible with most organic solvents—practically immiscible in water.

PHYSICAL DATA:

Mol. Wt.	147
F.R.	−10° to −22°C
B.R.	6° includ. 179°C
Sp. Gr., 15.5°/15.5°C.	1.310±.005
R.I., n20/D	1.550±.001
Flash Point	79°C

USES:
Solvent for gum, resins, tars, rubber, greases, sulfur; degreasing of metals, leather and wool; manufacture of dye intermediates; insecticide for domestic purposes; ingredient of paint and tar removers; heat transfer medium for condensing vapor systems.

1, 2, 4-TRICHLOROBENZENE — $C_6H_3Cl_3$

Tech.

DESCRIPTION:
Clear, almost colorless mobile liquid having a characteristic chlorobenzene odor. Completely miscible with most organic solvents; practically immiscible in water.

PHYSICAL DATA:

Mol. Wt.	181.5
F.P.	10°C
Dist. R.	205° to 235°C
Sp. Gr., 15.5°/15.5°C.	1.465±.003
R.I., n20/D	1.570±.002
Flash Point	118°C

USES:
As an insecticide, it is particularly effective as a soil poison in termite eradication; solvent for fats, oils, waxes, resins; as a heat transfer medium, in chemical synthesis for manufacture of dye intermediates and other organic chemicals.

PARADICHLOROBENZENE — $C_6H_4Cl_2$

(1,4-dichlorobenzene)

DESCRIPTION:
White to clear, transparent crystals with a pleasant aromatic odor. Soluble in most organic solvents; insoluble in water. Available in seven regular sizes.

PHYSICAL DATA:

Mol. Wt.	147
M.P.	53°C
B.P.	173°C
Flash Point	73°C
Fire Point	108°C

USES:
Recommended and widely accepted as a highly effective insecticide for agricultural and domestic purposes. Also used in the manufacture of sanitary specialties such as deodorants. As a chemical intermediate in the preparation of such chemicals as dyestuffs.

MONOCHLOROBENZENE — C_6H_5Cl

(phenyl chloride)

DESCRIPTION:
Clear, colorless, moderately volatile liquid, with a characteristic mild odor. Completely miscible with most organic solvents; immiscible with water.

PHYSICAL DATA:

Mol. Wt.	112.5
F.P.	−44°C
B.R.	131.3° to 132.3°C
Sp. Gr., 15.5°/15.5°C.	1.113±.001
R.I., n20/D	1.524
Flash Point	29°C

USES:
Intermediate in manufacture of insecticides, dyestuffs, drugs, perfumes, and other organic chemicals; solvent for paints, varnishes, lacquers; general organic solvent; heat transfer medium for condensing vapor systems.

From the Salt of the Earth

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SODIUM SULFIDE • SODIUM SULFHYDRATE • SODIUM BENZOATE • CAUSTIC SODA • MURIATIC ACID • PARADICHLOROBENZENE • CHLORINE

sive dirt collection is avoided. Brush or spray can be used in application. Two coats should supply maximum weather resistance. Brooklyn Varnish suggests use in plant maintenance, or iron and steel construction on bridges, barges, dry docks, and similarly exposed projects.

Wireworm Control

Improved insecticide lowers cost, increases effectiveness.

Gamma benzene hexachloride in a new formulation can cut in half the per-acre cost of treating seed grain for wireworm control, according to the agricultural chemicals division of Canadian Industries, Ltd. Estimated cost is $1.45 an acre.

Known commercially as Benesan, the product was made up previously as a combination insecticide and fungicide. Eliminating the mercury content and more than doubling the amount of the potent gamma isomer produced a product exclusively for insect control, and only half the amount is required to treat the same area as the former combination product.

Dusting two ounces on seed grain before planting reduces wireworm population of one acre to a point where there is little danger of serious damage for a period of at least three or four years.

Greaseless Lubricant

All-purpose lubricant has no melting point.

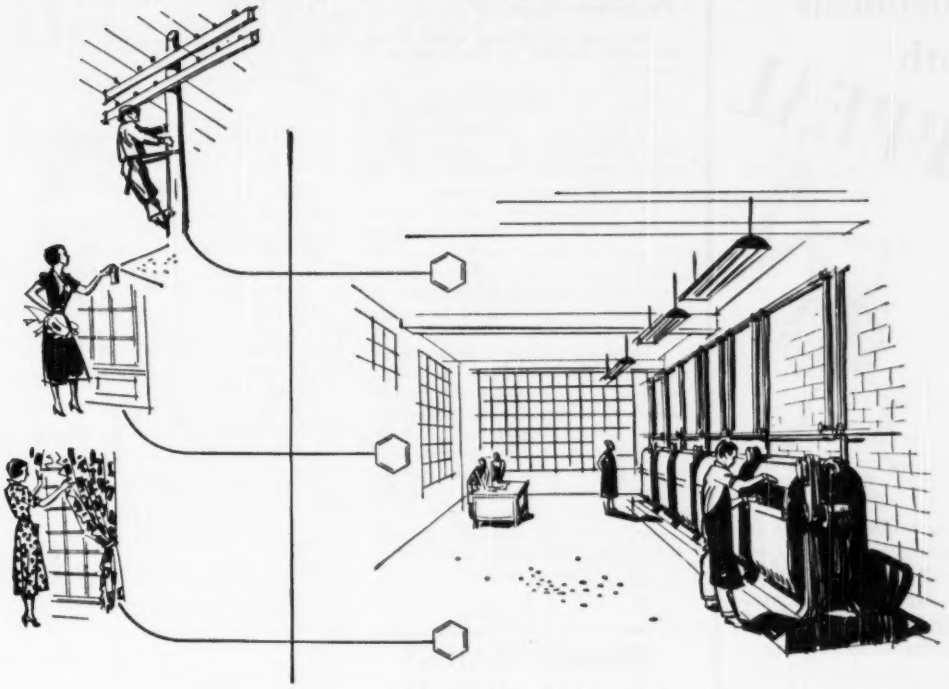
Warren Refining & Chemical Co., 750 Prospect Ave., Cleveland, is calling its new lubricant Plastilube, "the successor to grease," since, containing no metallic soaps of fatty acids, it is not, strictly speaking, a grease.

Instead, the products used for thickening the oil are various reaction products of montmorillonite and various organic cations. These reaction products form a physical jell with petroleum oils, and do not depend upon the maintenance of a matrix to hold the oil. As a result there is no possibility of a change in phase from solid to liquid.

In addition to the non-melting feature, Plastilube possesses greater adhesive qualities, excellent pumpability at low temperatures and does not break down during working, according to Warren. Such qualties are supposed to give a longer service life and subsequent economy.

Plastilube is now in use in many types of industries, such as industrial plants, coal strip and deep mines, contractors' equipment, quarries, and others. It is available in NLGI grades Nos. 0, 1, 2, and 3.

MONOCHLOROBENZENE



Builds the products that America buys

Monochlorobenzene daily demonstrates its facility as a chemical building block. The end products made from it read like a consumer's "Who's Who". A solvent for certain synthetic rubbers, it is used in many industrial applications—ranging from linemen's gloves to gaskets. Many articles in your daily life—from the house you live in to the DDT you use to kill insects—depend on this chemical.

Monochlorobenzene is used in making phenol, which is further processed to make a variety of materials—from resins for colorful table and counter tops to wood treating chemicals and insulation bonding adhesives.

Both monochlorobenzene and aniline, one of its important derivatives, are used extensively in the production of dyes.

Dow is a leading producer of monochlorobenzene, and—with ample capacities and nation-wide distribution—is a *dependable* source of supply. For information and technical assistance, write us at Midland.

THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

***DOW ALSO PRODUCES** over 600 chemicals including: caustic soda, phenol, aniline, hydrochloric acid, propylene oxide, epsom salt, ethylene oxide, and other basic, industrial, pharmaceutical and agricultural chemicals.*

DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY AND AGRICULTURE

Protective Coating

Series of plastic-base coatings can be easily applied to many types of surfaces.

Specialty Coatings Laboratory, 1721 N. Water St., Milwaukee 2, Wis., has developed a series of plastic-base coatings to solve specific corrosion-proofing problems. These can easily be applied to many types of surfaces.

The first of the new coatings, known as the V-200 series, are recommended for use over metal, wood, or concrete wherever a simplified coating system is required to withstand the corrosive vapors present in chemical or processing plants.

The V-200 coatings may be applied by spray, brush, or dip to be quickly air dried or baked and yield a flexible, abrasion-resistant coating highly adherent even to polished metal surfaces. The corrosion-inhibitive pigments within the system protect metals from underfilm corrosion thereby giving the system longer life expectancy when subjected to salt atmospheres, alcohols, soaps, fruit juices, acids and al-

(Turn to page 792)

TRADE MARKS OF THE MONTH

From Official Gazette—Vol. 630, Nos. 3-5 (Jan. 17-31) and Vol. 631, No. 1 (Feb. 7).

Pfister Chemical Works. Chemicals used as dyestuffs and intermediates. 569,636. Pfister Chemical Works, Inc.

HUSKY. Alcohol anti-freeze and permanent type anti-freeze. 569,921. Western Oil and Fuel Co.

(Symbol) Ironing wax. 569,993. Reliable Household Specialties Mfg. Co.

SCOTCH. Pressure-sensitive adhesive tapes. 570,310. Minnesota Mining & Mfg. Co.

SECURITY A-1 LUSTERIZING FORMULA. Chemical composition in liquid form sprayed on furs to improve their luster. 570,662. Security Fur Seal Co., Inc.

FOSOL. Naptha solvent for paints. 570,894. Freedom-Valvoline Oil Co.

CHEM-DEE. Chemical solution used on fabrics to render them water-repellent. 570,946. Chemical Development Co.

VIRGO SALT. Composition consisting of a caustic alkali containing minor proportions of an oxidizing agent used in the form of a fused bath, for oxidizing dense firmly adherent oxide on the surface of metals preparatory to removal thereof by a dip into a bath of dilute inorganic acid. 571,078. Hooker Electrochemical Co.

METLA-COTA. Compound for dissolving scale. 571,100. State Mfg. Co.

R-M. Conditioner for metal surfaces and galvanized and zinc surfaces preparatory to painting. 571,163. Rinshed-Mason Co.

TESORO. Sudsing cleaner, cleanser, and detergent. 571,493. Procter & Gamble Co.

RSR. Enzymatic products for use as cleaning compounds and removal of proteins and starch from textile and other materials. 571,829. Wallerstein Co., Inc.

HAMICOLA. Transparent liquid for softening and plasticizing in the textile, leather, and paper industries. 571,903. Haas-Miller Corp.

KOR. Liquid used for dissolving sludge throughout the entire fuel oil system. 572,752. Kor Corp.

(Symbol) Toilet and bath soap. 579,451. Procter & Gamble Co.

HYPOdee. Insecticide. 502,217. Hydroponic Chemical Co., Inc.

FIENDSPRAY. Insecticides. 503,308. McCambridge & McCambridge Co.

Sturman's. Dry cleaner in form of volatile cleaning fluid. 510,408. Sturman Mfg. Co.

Painticide. Paints containing D. D. T. 514,696. Clyde A. Farr.

ASEOL. Lubricating oils; lubricating greases; emulsifying oils; emulsifying oils for use as a cooling paste for metal working cutting oils. 518,806. Adolf Schmids Erben A. G.

Super-krome. Aluminum, bronze, and gold powder and paint. 520,533. Sheffield Bronze Paint Corp.

MULE-HIDE. Ready mixed and paste paints. 520,729. The Lehon Co.

KLEEN-R-KREME. Waterless cleaner for removing grease, etc., from hands and for use in cleaning other surfaces. 520,928. Diesel Filter Co.

CAMAY. Toilet and bath soap. 520,966. Procter & Gamble Co.

Niatox. Insecticidal composition for use on plants and animals. 522,853. Food Machinery and Chemical Corp.

VISLUBE. Lubricating oil. 526,832. Pure Oil Co.

DRYTEX. Processing fluids for making hats, fabrics, yarns, papers, etc. water repellent. 529,932. Royce Chemical Co.

DIXLUBE. Lubricating oils and greases. 530,111. National Lubricants Corp.

GILMAN. Exterior and interior paints and Varnishes. 534,767. Gilman Paint and Varnish Co.

PLASTICUT. Machining compound specially adapted as coolant-lubricant for machining plastics. 535,679. Bee Chemical Co.

VISCA-LUBE. Lubricant greases. 537,212. Marquette Petroleum Products, Inc.

HYDRO-DRIVE. Hydraulic oils. 539,703. E. F. Houghton & Co.

PERFECTION. Embalming fluid. 544,393. Remmer Chemical Co.

FLO-CILLIN. For penicillin compounds. 544,957. Bristol Labs. Inc.

Miracle Powder. Lubricating oils and greases and graphite lubricants in liquid form. 552,069. Miracle Lubricating Corp.

Wing-Speed. Enamel paint. 552,737. Alston-Lucas Paint Co.

NINOL. Surface active agents, emulsifying agents, wetting agents, and dispersing agents. 555,617. Ninol Labs.

ARKOLENE. Sulfonic acid compounds useful as wetting agents and penetrants in the wet processing of textiles. 555,980. Arkansas Co., Inc.

INTER-PASTEK. Ready-mixed paints, varnishes and solvents therefor, and paste paints. 557,042. International Paint Co., Inc.

RHODOL. Photographic developers. 557,162. Societe des Usines Chemiques Rhone-Poulenc.

SEALFAS. Heavy liquid adhesive cements and surface coatings for porous materials. 558,708. Benjamin Foster Co.

HYDRONOX. Insectide. 560,554. Farnam Co.

HARDNOX ALKALI. Inorganic detergent having water softening and germicidal properties. 561,894. Diamond Alkali Co.

HITEST ALKALI. Inorganic detergent having water softening and germicidal properties. 561,896. Diamond Alkali Co.

G P. Adhesives in capsul form. 563,017. R. P. Scherer Corp.

G. P. Adhesive in capsul form. 563,018. R. P. Scherer Corp.

LOCKED-IN. For laundry starch. 564,956. National Textile & Chemical Lab.

MOLYCLAD. Liquid composition used as protective coating for metal surfaces. 566,552. Sherwin-Williams Co.

HI-TEN. Textile oils. 566,823. Emery Industries, Inc.

DEOCIDE. Germicidal deodorant and disinfectant. 566,953. Sandack Corp., Inc.

PURE. Household oil; rubber lubricant; lubricating stick. 567,923. Pure Oil Co.

Plascor. Buffing and polishing compound for use on plastic surfaces. 568,814. United Labs Co.

VELVA-SEAL. Paint primers and fillers and varnish type wall sealing preparations. 569,258. Foy Paint Co., Inc .

BACTINE. For topical germicide. 570,426. Miles Labs., Inc.

CLEARIGHT FINISH. Resinous impregnating agents used to stabilize cotton, rayon, or acetate textile fabrics and combinations thereof. 570,525. United Merchants and Mfrs, Inc.

LUBE-LITH. Lubricating greases. 570,829. Battenfeld Grease & Oil Corp.

MAGNET. Lubricating oils. 570,896. Freedom-Valvoline Oil Co.

CELLO-GARD. Preservative for wood, cloth, netting, and rope. 572,534. Thompson-Hayward Chemical Co.

ABSORBO. Compound for absorbing moisture. 572,575. Merlite Industries Inc.

PURJ. Dust filter adhesives. 574,008. Atlas Powder Co.

CASITE. Oil additive for use in internal combustion engines and also used as penetrating oil and rust solvent. 575,567. Casite Corp.

FORMULABS. Lacquers for use on textiles, metals, leather, wood, glass, ceramics, tile, and paper. 576,213. Formulabs.

BENDIX. Lubricating and anti-corrosive oils and greases. 576,394. Bendix Aviation Corp.

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- "ELASTEX" 28-P Plasticizer
- Niacin (Nicotinic Acid)
- Pyridines
- Picolines
- Quinoline
- Tar Acid Oils
- Neutral Coal-tar Oils
- Coal-tar Creosote
- CUMAR* Paracoumarone-Indene Resin
- Carbonex* Rubber Compounding Hydrocarbon
- Bardol* Rubber Compounding Oil
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NEW PRODUCTS & PROCESSES

Structural Styrene

Polystyrene-glass fiber mat gives high strength, convenience of fabrication.

Beauty, brilliance and strength are combined in a new thermoplastic structural material offered by Monsanto Chemical Co., St. Louis 4, Mo.

The new product, loaded glass mat, is polystyrene reinforced with random glass fiber.

The Lustrex loaded glass mat is designed to provide the plastics fabricator with an inexpensive, easily handled product for fashioning many articles heretofore limited by complicated molding techniques common to other resin-glass combinations. Molded in a compression machine on a short press-time cycle, the new mat affords a finished item with the advantages of molded styrene plus greatly improved strengths.

Lustrex loaded glass mat is recommended for molding trays for both industrial and home use, housings for mechanical devices, decorative paneling, structural laminates, boxes and other containers where improved strengths and chemical resistance is needed.

Vinyl Resin

Easy processability and good electrical characteristics mark new vinyl formulation.

A new easy-processing vinyl resin for use in the manufacture of draperies, upholstery, table coverings, flooring, electrical wire and cable and many other plastic products for the consumer and industrial fields, has been developed by Naugatuck Chemical division, United States Rubber Co.

Laboratory and field tests have shown the new resin, Marvinol VR-20, to be the easiest processing electrical grade resin yet developed. It also exhibits excellent clarity and gloss.

In the calendering field, the new resin will eliminate or drastically reduce the need for copolymer processing-aid resins. Its use will permit lowering Banbury and calender temperatures 10 to 15 degrees below previous practice.

Extrusions of Marvinol VR-20 compounds have shown excellent gloss at temperatures 10 to 20 degrees below those used with most proprietary resins and its gloss retention is good even with a high percentage of filler.

The resin may be handled on conventional vinyl-processing equipment. No special machinery is needed for mixing, extruding, calendering or molding.

Production of Marvinol VR-20 is now underway at the Naugatuck Chemical division's plant in Painesville, Ohio.

Anti-Static Prevents Dusty Polystyrene

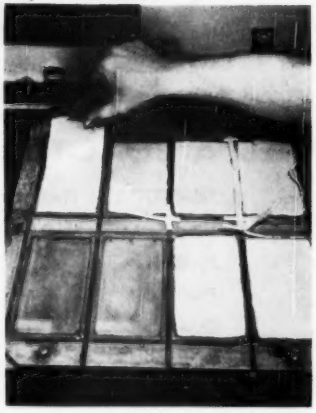
Liquid applied to polystyrene plastic prevents dust attraction.

Now offered by Bee Chemical Co., 13799 South Avenue "O", Chicago 33, Ill., is an inexpensive, easily applied treatment for polystyrene to prevent attraction of dust. The material, a liquid, is called Logo Stat, and is applied by dipping so no special equipment is required. Application immediately after moulding prevents dust accumulation during handling.

Logo Stat dries rapidly and is not water-soluble following application, although it may be removed by ordinary soap and water when desired. Unless so removed, effectiveness is claimed for an indefinite period, since normal handling does not readily affect the coating. The material is not a wax and is said to be unnoticeable on the plastic.

Samples are available to potential users.

Teflon Enamels



Teflon suspensoids are the basis of new heat- and chemical-resistant enamels. Their unique properties justify their high cost—$65 to $100 a gallon—for many applications. One such property is that most materials won't adhere to Teflon coatings, and thus they are used to coat rubber molds, as shown above, to keep the product from sticking.

Gypsum Impregnant

Liquid resin hardens gypsum plaster castings.

Plaster casts in combination with plastics resins represent a new category of materials possessing the desirable characteristics of organic and inorganic substances.

"Aquastone," a product of Furane Plastics and Chemicals Co., 719 W. Broadway, Glendale 4, Calif., is a liquid resin which, when added to water, will serve as a fortifying or hardening agent for gypsum plaster castings. It is added to water before plaster is introduced and the resulting mixture sets at room temperature to a hard, strong casting.

Phenolic Molding

New low-cost molding compound characterized by high gloss and strength.

A new mineral-filled phenolic molding compound, Durez 14893 Black, featuring excellent heat resistance, exceptionally good finish, extremely fast cure, and a relatively low specific gravity, is now made by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.

The new material has good strength characteristics and is suitable for molding around inserts. Molded test pieces which have been baked for 24 hours at 450° F. are actually stronger after the test and retain their unusually high-gloss finish. After 200 hours at 450° F., the surface appearance of the material is still relatively unimpaired. Intermittent exposure to higher temperatures is equally safe.

High-frequency preheating characteristics of Durez 14893 Black are similar to other mineral-filled materials. The material can be molded either by the compression or plunger methods, and its fast cure results in exceptional molding economy.

Properties	
Specific gravity	1.57 avg.
Water absorption, %	0.20 ±.01
Flexural strength, p.s.i.	7000 min.
Impact strength, F.P. per in.	0.26 min.
Distortion under heat, °F.	340 min.

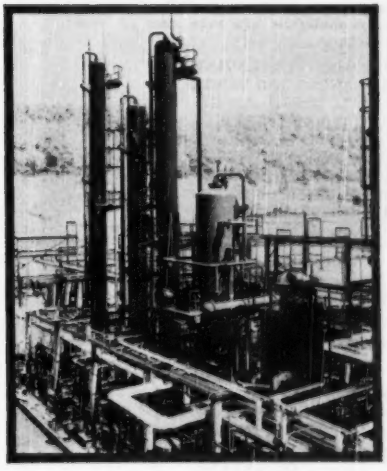
Rigid Vinyl

New vinyl formulation gives rigid plastics competitive with styrene, acrylics and thermosets.

Production in commercial quantities of a new Geon resin, 400 X 65, which is expected to open up many new uses for vinyls in the field of rigid molding, has been undertaken by B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, Ohio.

Possessing high thermoplasticity, great solubility and excellent processing characteristics at moderate temperatures, the new product introduces the properties of Geon polyvinyl chloride resin into another interesting product

Columbia's ability to supply



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Here's an assured source of Muriatic Acid that is providing excellent service and other advantages for numerous users. Production capacity is sufficient to guarantee prompt service. You are invited to obtain information by writing Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth and Bellefield, Pittsburgh 13, Pennsylvania.

Photo shows a portion of the installations at Natrium, West Virginia, where Columbia Muriatic Acid is produced.

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range where certain material limitations heretofore have restricted its use. Geon 400 X 65 can be extruded, calendered or molded in unplasticized form and at temperatures under 300° F.

Approximately 5% of vinyl resin poundage in 1949 went into rigid or semi-rigid applications, with vinyls enjoying less than 1% of the total potential market. Principal reason for this low percentage of market was the relatively poor processability of many currently available vinyl resins. However, outstanding properties of vinyls make them most adaptable to rigid applications.

Geon 400 X 65's excellent heat stability for long periods makes it possible, through proper compounding, to produce transparent molding, as well as calendering and extrusion compounds. Possessing excellent clarity, 400 X 65 can be used to produce crystal clear, rigid sheet or piping. Low-viscosity cements can also be formulated by dissolving the new resin in solvent mixtures of acetone and an aromatic component.

Its flexural strength, resistance to cold flow and warpage, and wear resistance make it an excellent phonograph record molding material. High bulk density allows up to 30% higher loading per batch in Banbury mixing than with conventional resins.

Dioctyl Adipate

New Goodrich plasticizer is odorless, designed for vinyls used at low temperatures.

An odorless, dioctyl adipate (GP 233) available commercially as a primary plasticizer for vinyls and other synthetic resins is offered by B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, Ohio.

Clear, completely odor-free, and with exceptionally low acid content, GP 233 has been specifically designed to provide improved low-temperature properties to vinyl and other synthetic resin compounds. Laboratory tests show that GP 233-plasticized vinyl compounds will withstand temperatures as low as —70° F. without becoming brittle, while dioctyl phthalate type plasticized compounds tended to become brittle at —40° F.

The efficiency or solvent power of the new plasticizer, which is greater than that of DOP, should interest manufacturers who wish to achieve maximum resilience, pliability, "drape", and low-temperature flexibility with a minimum of plasticizer.

GP 233 may be used singly or may be blended with other plasticizers for use in all of the conventional processing techniques, including calendering, extrusion, and molding. In the preparation of organosol or plastisol formulations it has demonstrated special usefulness. Chemical properties of GP 233 are:

Molecular weight	370
Specific gravity @ 25/15.5°C.	0.925
Color—Hazen No.	100 maximum
Boiling range @ 5 mm Hg	98% between 210° C—218° C.
Volatility mg/cm²/hour @ 150°C.	3.5
Odor	None
Refractive index	1.4465
Viscosity @ 25°C.	18 centipoise
Weight per gal. @ 25°C.	7.70 pounds

Enamel Resins

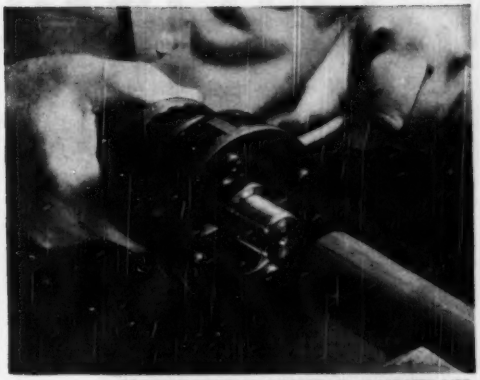
Two urea-formaldehyde resins are designed as components of finishes.

Two new urea-formaldeyhde resins, designated as Uformites F-210 and F-233, have been introduced to the industrial coatings field by the Resinous Products Division of Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.

Uformite F-210 is said to provide the high viscosity and wide compatibility required by many industrial baking enamels. Excellent gloss and fast curing speed accompany these properties. In conventional proportions—10% to 40%—this resin is suggested for general use in finishes for household appliances, kitchen cabinets, and hospital and surgical equipment.

Its compatibility with many types of alkyd resins produces extremely glossy coatings, yet it retains comparatively

Get this new HAND threader for "Karbate" Pipe BRAND



TOOL ABOUT TO BE INSERTED IN "KARBATE" PIPE.

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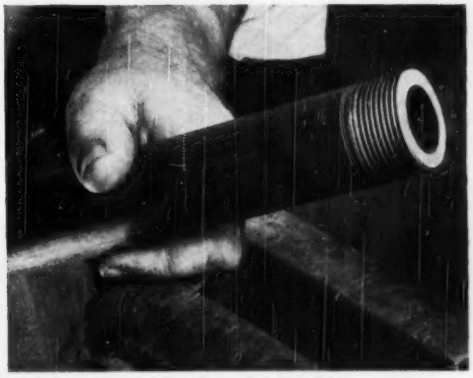

TOOL REMOVED. NOTE CLEAN, SHARP THREADS.

WRITE to National Carbon today and ask us for complete information on the new hand-threading tool for use with "Karbate" impervious graphite pipe. The new tool eliminates the need for an expensive lathe and is easy to carry to any job site. It cuts "Karbate" impervious graphite like wood . . . delivers clean, sharp threads . . . is inexpensive to buy. If you like, we'll have a salesman call and demonstrate the tool to you in person, without cost or obligation.

MORE THAN DOUBLE THE USABLE LIGHT! . . .

The biggest news since the invention of flashlights—the brand new "Eveready" No. 1050 flashlight battery—gives more than double the usable brilliant white light for critical uses than any other flashlight battery we have ever made.

NO METAL CAN TO LEAK OR CORRODE!

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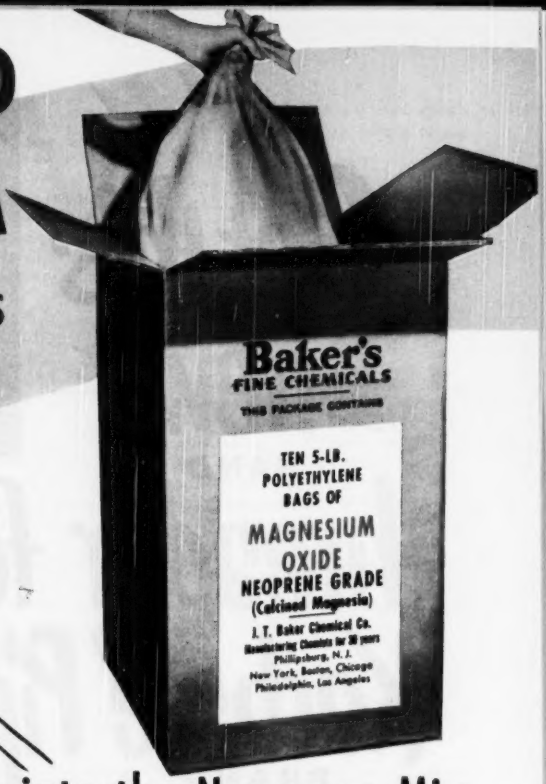
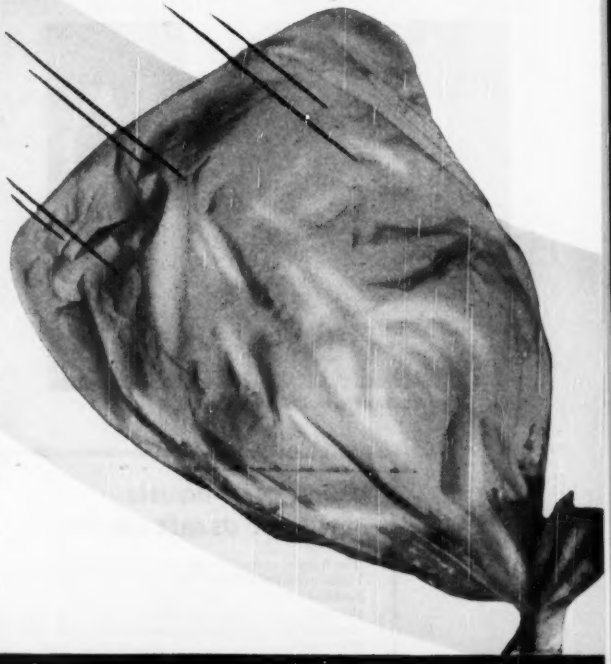


ready to throw into the Neoprene Mix



Baker can now supply you Magnesium Oxide, Neoprene Grade, in Polyethylene 5-pound bags packed 10 to the carton.

These highly protective bags are great time savers. They are light and easy to handle. They are always clean; need not be emptied. They dissolve right in the mix.

Moreover, these bags give added protection to the most sensitive ingredient that you use in compounding Neoprene: Magnesium Oxide (Calcined Magnesia).

The package Baker selects for Magnesium Oxide has to be good. It must protect the product from moisture with the same care that Baker uses to protect the uniformity of its Calcined Magnesia through controlled temperatures. With Baker's special electric furnaces, calcining temperatures never vary more than 5 per cent.

Temperature control, uniformity of product and packaging to prevent moisture infiltration are three of the important factors to assure Calcined Magnesia that is trouble-free for Neoprene compounding.

You get all three of these important features when you buy your Calcined Magnesia from Baker.

For test samples and prices write: J. T. Baker Chemical Co., *Executive Offices,* Phillipsburg, New Jersey.

Baker's

Baker's Chemicals

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high viscosity when diluted, thus leading to economical coatings of low solids content. The resin assertedly tolerates large quantities of mineral thinner, and has high water resistance when used in a typical baked enamel of the alkyd type. Its adhesion in one-coat enamels is good, even when used with large concentrations of non-oxidizing alkyds.

Uformite F-233 is said to combine compatibility with highly polymerized as well as long-oil alkyds, high tolerance for mineral thinner, and fast baking speed. It permits preparation of fast-baking industrial coatings with high proportions of inexpensive aliphatic solvents. Its compatibility with alkyds prevents "kick-out" and helps to produce glossy coatings. Data sheets on both resins are available from the manufacturer.

Rubber Chemical

New product activates rubber accelerators with little increase in scorchiness.

Aktone, a new amine-type accelerator activator, is designed for use with thiazole and thiuram primary accelerators. Developed in the research laboratories of the J. M. Huber Corporation, 342 Madison Ave., New York 17, N. Y., Aktone effectively activates MBT and MBTS both in natural rubber and GR-S with little or no increase in scorchiness.

More active in GR-S, Aktone helps to reach an equal state of cure in both hydrocarbons in blends of natural rubber and GR-S. In natural rubber, Aktone is very effective in gum stocks and those with clay and furnace black loadings.

For GR-S and "cold rubber" camelback compounds, a combination of equal parts of Aktone and MBTS has proven to give excellent acceleration. This combination substantially reduces the tendency to "set up" in storage and maintains curing rates after long storage periods.

Glyceryl Ricinoleate

New process claimed to give lighter-colored product at lower price.

Glyceryl mono ricinoleate is now being produced by a new process by Glyco Products Co., Inc., 26 Court St., Brooklyn 2, N. Y. This process makes possible the production of an improved, lighter colored product not dispersible in water and at a substantially lower price than heretofore available.

This new material, S-1153, is a very light yellow liquid, of low free fatty acid content, and having a solidification point below —30° C. It is of interest as a plasticizer for synthetic rubbers, giving good flexibility and lubrication at low concentrations. Having

a low freezing point, it is indicated for low-temperature work and its insolubility in hydrocarbons makes it particularly valuable for oil-resistant compounds.

It is used as an emulsifying agent and stabilizer for water-in-oil emulsions. S-1153 is compatible with, and may be modified with, cationic and anionic surface-active agents for use as an emulsifier for oil-in-water emulsions.

Silicone Rubbers

Two new rubbers are especially designed for extreme temperature applications.

New silicone rubber compounds for special applications are being developed by the General Electric Co.'s Chemical Department, Pittsfield, Mass.

Two new low durometer compounds, known as G-E No. 13011 and G-E No. 13012 are for use in extreme temperature applications or shock mounts, light spring-loaded gaskets, damping devices, and related uses where conventional or silicone sponged-rubber parts either deteriorate or take compression "set" and collapse.

Another general purpose silicone rubber compound, known as G-E No. 13013, is of particular interest to specialty fabricators. It has uniformly good general properties and is excellent to mold and extrude in fabrication of parts.

A red-colored, medium (50) durometer stock, it exhibits excellent flow and fine parting lines in molding and has equally good flow in extrusion work.

Gas Drying

Siliceous desiccant improves efficiency, cuts cost of drying natural gas.

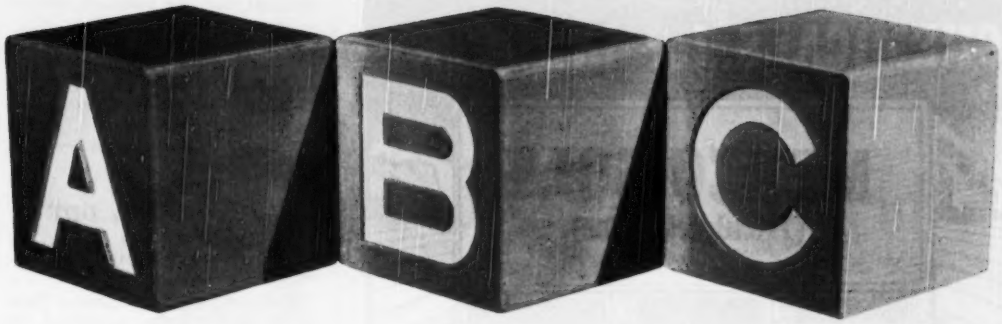
Successful application of S/V Sovabead, a moisture-adsorbing chemical, in the commercial drying of natural gas before it is transported through pipelines has been announced by the Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, N. Y.

Sovabead is a chemically inert solid siliceous material in the form of beads. Extensive field tests over the past three years have shown it to be extremely effective for drying natural gas. Specifically, the tests have proved:

1. Sovabead doubles the adsorption capacity of the drying towers.

2. The overall operating efficiency of natural gas drying units is enhanced through elimination of "caking" and reduction of pressure drops, "channeling" and "dusting"—all of which are difficulties experienced with other solid desiccants.

3. Sovabead resists fouling by so-called "sour" gas, with the result that



"Building Blocks" for sale

Not for your youngster but for you are these chemical building blocks —specifically, olefins and paraffins. These chemicals are intermediates in the production of many chemicals including alkyl phenols, alkyl mercaptans, alcohols, and halogenated products. If you presently produce or are doing research work with any of these end products, you should be interested in Atlantic's materials.

Diisobutylene Approximate composition of 80 weight percent 2,4,4-trimethylpentene-1 and 20 weight percent 2,4,4-trimethylpentene-2. Recent improvements in processing techniques have narrowed the boiling range to 101.8 to 105.0° C. Available in drums and tank cars.

Triisobutylene Principal components consisting of 2,4,4,6,6-pentamethylheptene-1; 2,4,4,6,6-pentamethylheptene-2; 2,2,4,6,6-pentamethylheptene-3; 2-neopentyl-4,4-dimethylpentene-1. Available in drums and tank cars.

Ultrax 20 Water white mixture of predominately straight chain paraffin hydrocarbons averaging 20 carbon atoms per molecule. Available in drums and tank cars.

In addition to these commercially available olefins, experimental quantities of hexenes and nonenes can be supplied for research work. We'll be glad to send you our Technical Bulletin giving further information on these Atlantic products. The Atlantic Refining Company, Chemical Products Section, 260 S. Broad St., Philadelphia 1, Pa.

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desiccant costs are materially reduced by increased service life.

4. Sovabead maintains high adsorption capacities while maintaining the necessary low dewpoints even when the temperature of inlet gases goes as high as 120° F.

5. Use of Sovabead brings lower ultimate drying costs.

High-Concentration DDT

Wettable powder and dust concentrate containing 75% DDT offer economy and convenience.

Michigan Chemical Corp., Saint Louis, Michigan, has announced the addition of 75% DDT wettable powder and 75% DDT dust concentrate to its line of agricultural chemicals.

The new wettable powder formula carries a higher concentration of DDT than has heretofore been available in this type of product, offering freight savings, storage economy, and convenience in use. It also incorporates recent improvements in manufacture, being air-milled to an average particle diameter of less than 4 microns. The low inert-ingredient content makes it possible to use the higher spray concentrations now desired for community spraying and malaria mosquito control work.

The powder is quickly wettable in either hard or soft water and will be available either as a high-suspension material for residual spraying or as a low-suspension material for quick-breaking corn-spraying suspensions. It has excellent sticking qualities and leaves a minimum of visible residue, being comparable to emulsion formulations in these respects.

The 75% DDT dust concentrate is an air-milled formula made to the same strict particle size specifications as the wettable powder.

W and Mo for Corrosion

Tungsten and molybdenum compounds are colorless, more effective than chromates.

Corrosion of steel and iron by circulating water can be almost completely prevented by addition of small amounts of tungsten and molybdenum compounds, reports the University of Chicago.

The compounds, sodium tungstate, potassium tungstate, potassium molybdenate, and sodium molybdenate, are expected to be especially useful in the air-conditioning and cold-storage industries. Both of these industries make extensive use of steel pipes to circulate water or brine.

Dissolving a few hundred p.p.m. of the tungsten and molybdenum compounds in the circulating water or brine will stop rusting. Water cir-

Now! B&A Purified AMMONIUM SULFATE

Enlarged 10 Diameters

in a Special, New *Free-Flowing*

Highly *Uniform* Crystal Size

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2. Manufacture of dry yeast
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OTHER INDUSTRIES

1. In textile dye baths
2. In applying resins for water-proofing
3. In activating silica for water treatment purposes
4. In manufacture of storage battery plates
5. In production of synthetic jewels

B&A *Purified* Ammonium Sulfate has long been preferred by manufacturers of food and medicinal products for its constant uniformity and its superior high purity. Now this quality chemical is available in a special new *free-flowing*, highly *uniform* crystal size . . . adding desirable physical properties to its many advantages for process use.

B&A Purified Ammonium Sulfate differs distinctly from ordinary commercial ammonium sulfate. It is not a by-product material. Rather, it is produced by B&A as a basic fine chemical using pure raw materials. It assays 99% min. $(NH_4)_2SO_4$ and is low in iron, lead, and arsenic, thus providing a quality for the most exacting uses.

If your process calls for *purified* ammonium sulfate of unquestioned quality—Specify B&A . . . you'll be buying the best.

REAGENTS B·A STANDARD OF PURITY FINE CHEMICALS

BAKER & ADAMSON *Fine Chemicals*

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 RECTOR STREET, NEW YORK 6, N. Y.

Offices: Albany* • Atlanta • Baltimore • Birmingham* • Boston* • Bridgeport* • Buffalo* Charlotte* • Chicago* • Cleveland* • Denver* • Detroit* • Houston* Los Angeles* • Minneapolis • New York* • Philadelphia* • Pittsburgh* • Portland (Ore.) Providence* • St. Louis* • San Francisco* • Seattle • Wenatchee (Wash.) • Yakima (Wash.)

In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited • Montreal* • Toronto* • Vancouver*

SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

* Complete stocks are carried here.

culating through a steel pipe can corrode four pounds a year per square yard of exposed metal. Brine is even more corrosive.

These new anti-corrosion chemicals were discovered in the course of an investigation of chromates. The new compounds are currently more expensive than the chromates but have one major advantage over them: The chromates are a vivid yellow, which makes them unsuitable for use in processes where such color would be undesirable. The tungsten and molybdenum compounds are colorless, which extends the possibilities for use of corrosion inhibitors, including anti-corrosive paints.

• Heyden Chemical Corp., 393 Seventh Ave., New York, N. Y., is making available in pilot-plant quantities, a group of four **diacetals of pentaerythritol.** These new products, pentaerythritol diformal, pentaerythritol diacetal, pentaerythritol dipropional, and pentaerythritol dibutyral (n), are of interest to the research chemist as intermediates and also as compounds with interesting physical and chemical properties.

• The first two of a series of Kel-F (trifluorochloroethylene polymer) **dispersions** are now available from M. W. Kellogg Co., P. O. Box 469, Jersey City 3, N. J. These dispersions make Kel-F available in a form that permits application of Kel-F to materials and equipment not amenable to processing by conventional plastic molding.

• Columbia Organic Chemicals Co., Inc., 600 Capital Pl., Columbia 55, S. C., announces the availability of the following **bromine compounds** which are of interest as research intermediates: 2-bromo-2-butene *cis* and *trans*, b.p. 84-93°; 2-bromo-1-butene, b.p. 80-82°; 1-bromo-1-butene *cis* and *trans*, b. p. 87-94°; gamma-bromo-butyronitrile, b.p. 91-93°/12 mm.; 1-bromo-3-methylpentane, b.p. 146-148°; 4-bromoöctane, b.p. 186-188°; delta-bromovaleronitrile, b.p. 110-112°/12 mm.; 2,3-dibromobutane, b.p. 157-159°; 1,1-dibromo-1-butene, b.p. 149-151°; 2,3-dibromo-2-butene *cis* and *trans*, b.p. 145-152°; beta, beta-dibromo-diethyl ether, b.p. 115-117°/32 mm.; 1,1-dibromo-1-propene, b.p. 125-127°; heptamethylene dibromide, b.p. 138-140°/20 mm.; nonamethylene dibromide, b.p. 171-173°/20 mm.; pentabromoethane, m.p. 54-56°; alpha-phenylethyl bromide, b.p. 97-99°/17 mm.; tetrabromoethylene, b.p. 98-100°/15 mm.; 1,2,2-tribromobutane, b.p. 112-115°/40 mm.; 2,3,3-tribromobutane, b.p. 83-85°/11 mm.; 1,1,2-tribromopropane, b.p. 100-103°/20 mm.; n-tridecyl bromide, b.p. 162-164°/15 mm.; 1,2,3,4-tetrabromobutane, b.p. 180-184°/60 mm.

THE VISION BEHIND YOUR TELEVISION SCREEN

Mallinckrodt Chemicals of almost unbelievable purity help "brighten the picture" in TV–and many other products

The quality of a television image depends largely on the quality of the chemicals that go into the complex makeup of the tube: cathode emissive material, phosphors, and screen-laying solutions.

Typical of the Mallinckrodt Fine Chemicals for television is our special grade of *Sodium Sulfate*. Impurities are reduced to such infinitesimal traces that chemists can scarcely believe its analysis (left).

The far-sighted vision of Mallinckrodt research that gives the industry such products today may give *your products* better reception tomorrow. Starting materials of Mallinckrodt uniform purity help reduce rejects, maintain higher quality at lower cost in many plants. They may do the same in yours, too. Call your nearest Mallinckrodt representative or write:

QUANTITATIVE SPECTOGRAPHIC ANALYSIS OF A TYPICAL LOT OF MALLINCKRODT SPECIAL SODIUM SULFATE

Copper		0.3 ppm
Silver	Less than	0.1 ppm
Bismuth	Less than	0.1 ppm
Cobalt	Less than	0.5 ppm
Chromium	Less than	0.5 ppm
Cesium	Less than	0.1 ppm
Iron		0.2 ppm
Lithium		0.9 ppm
Manganese	Less than	0.1 ppm
Nickel	Less than	0.5 ppm
Aluminum		15.0 ppm
Barium	Less than	0.1 ppm
Cadmium	Less than	0.1 ppm
Lead		1.2 ppm
Silicon	Less than	1.0 ppm
Tin		0.3 ppm
Strontium	Less than	0.1 ppm
Titanium	Less than	0.5 ppm
Zinc	Less than	1.0 ppm

MALLINCKRODT CHEMICAL WORKS

Mallinckrodt St., St. Louis 7, Mo. / 72 Gold St., New York 8, N. Y.

CHICAGO • CINCINNATI • CLEVELAND • LOS ANGELES • MONTREAL • PHILADELPHIA • SAN FRANCISCO

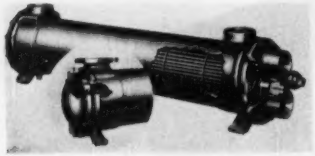
Manufacturers of Medicinal, Photographic, Analytical and Industrial Fine Chemicals

NEW EQUIPMENT

Low Cost Cu Heat Exchanger

Economy, larger transfer surface feature new all-cuprous exchangers.

A new line of standardized exchangers, featuring all-cuprous, removable tube bundle construction, is



now in quantity production by Ross Heater & Mfg. Co., 1407 West Ave., Buffalo 13, N. Y.

Designated Type BCP, the line is available in a broad range of sizes which are said not only to compare favorably in cost with many iron and steel shell units, but actually cost less in the smaller sizes.

Originally for service on Navy combat vessels, the Type BCP has been redesigned to achieve lower cost and larger transfer surface.

Humidity Controller

New instrument controls flow of humidifying agent.

An instrument which records and automatically controls humidity has been announced by the Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J. Utilizing the psychrometric wet and dry bulb principle, the controller automatically regulates the wet-bulb (relative-humidity) depression for which it is set, regardless of any fluctuations in the dry-bulb temperature.

Two pens operate on a circular 10-inch chart, simultaneously recording the dry-bulb temperature and the wet-bulb depression. The flow of the humidifying agent, moisture, steam or oil fog, is regulated by a valve which is operated by the control instrument. For applications involving gas, bars can be clamped on the case of the instrument to make it gas-tight.

Cooling-Water Control

Midget element controls cooling water temperature.

An insertion-type pneumatic temperature control for machines or processes using water as a cooling medium has been designed by Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa.

The new control is so small it can be installed in a two-inch water line. It is designed for use with Honeywell pneumatic valves on restricted, recirculated and other systems. A liquid-filled element is said to give the new device high sensitivity and fast action.

Wide Angle Spray Nozzle

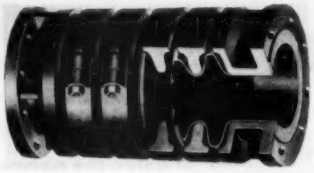
Produces uniform 180-deg. umbrella spray.

Unusually wide angle sprays can be obtained by means of a newly designed spiral nozzle made by Bete Fog Nozzle Co., Greenfield, Mass.

In addition to the wide angle of spray, the new nozzle is designed for low flow rates and requires extremely low pressures, according to the manufacturer. It will produce fine and uniform drop sizes with a 180-degree umbrella spray of wide coverage.

The nozzle is available in two sizes: ½ to 2 gpm. and 1½ to 4 gpm.

Controlled Pipeline Expansion



Expansion and contraction caused by temperature changes in pipelines can be controlled by this new packless, in-line, corrugated expansion joint with control rings. Its compactness makes the joint especially suited for trenches, tunnels and other locations where space is at a premium. Joints are said to be completely maintenance-free and make manholes in underground installations unnecessary. It is made by Chicago Metal Hose Corp., 1306 S. 3rd St., Maywood, Ill.

New Industrial Water Heater

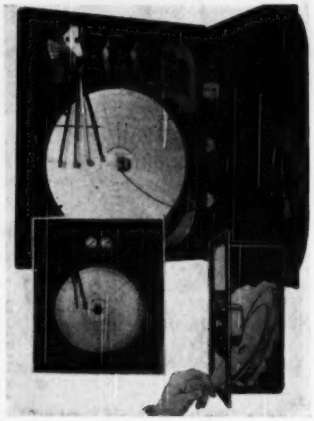
Operates on forced circulation principle, guarantees 75% thermal efficiency.

A new industrial water heater, with a capacity of 600 gallons per hour at 80° F. temperature rise, is announced by Clayton Manufacturing Company, El Monte, Calif.

Utilizing a high velocity, forced circulation principle, the water heater has a guaranteed thermal efficiency of 75%, oil or gas fired. Controls are fully automatic, including a high-temperature safety cut-off. Simultaneous delivery of hot water at two different temperatures is obtained by means of a special blending assembly.

Designed for a wide variety of applications, including laundries (self-service or commercial), restaurants, motels, and other similar installations, the water heater stands 5 ft. high, and requires a space of 5 ft. by 3 ft. The 140-gal., fully insulated storage tank is an integral part of the unit.

Pressure & Temperature Recorder



Penn Industrial Instrument Corp., 3116 N. 17th St., Philadelphia 32, has a new and amplified line of pressure and temperature recorders. Temperature measurement by the self-actuated tube systems of the gas-filled, vapor tension and liquid-filled types ranges from —100°F. to +800°F. New case design accommodates up to four pens (any combination of temperature and pressure). Storage space is provided within the case for 200 charts and 4 bottles of ink.

Speed Controller

Specially designed for uses requiring frequent speed changes.

A form of speed control recently developed by Allis-Chalmers, Milwaukee, Wis., for applications requiring frequent speed changes or for making adjustments without shutting down the drive is now being employed on mixers in chemical plants.

The combination consists of a new Vari-Pitch automatic sheave, companion sheave, wide-range Texrope belts and Texslide motor base. It is being used for motion control speed change ratios up to 2 to 1.

Desired speed variances of the driven machine are quickly obtained by simply turning the adjusting screw on the motor base with any commercial wrench. The drive is particularly applicable to high starting torque since it permits the belts to ride at smaller pitch diameters during acceleration. The new sheave utilizes the Vari-Pitch sheave principle of moving angular faced discs toward

Stop VALVE SHOPPING!

for BRONZE — IRON — STEEL — CORROSION-RESISTING Valves

POWELL *makes them all*

Fig. 1843 — 200-pound Monel Metal Swing Check Valve with screwed ends and screwed-in cap.

Fig. 1832-IN — 200-pound Inconel Gate Valve with screwed ends, screwed-in bonnet and inside screw rising stem.

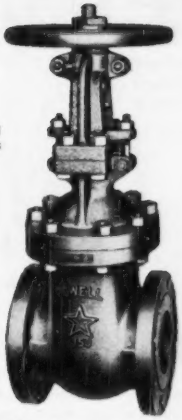


Fig. 1503—Class 150-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

When you want to buy a new suit, you don't shop for the coat in one place, the vest in another, and the trousers in still another.

But that's just what you do if you get your bronze or iron valves from one source, cast steel valves from another and possibly special design or alloy valves from several others.

No one makes better bronze, iron or steel valves than we do. And, in the field of special design and alloy valves for corrosion-resistance, Powell has always led the way. Today Powell makes the *only* COMPLETE line of these valves available.

In short, Powell makes all kinds of valves* needed in your industry—and makes them better. So stop shopping for valves. Standardize on Powell . . . and centralize responsibility for the efficient operation of the entire flow control system in your plant.

Fig. 241—Large 125-pound Iron Body Bronze Mounted Globe Valve. Outside screw rising stem, bolted flanged yoke, regrindable, renewable bronze seat and disc. Also available in All Iron.

Flush Bottom Tank Valve. Available in two designs. **Fig. 2309**—disc rises into tank to open; **Fig. 2310**—disc lowers into body.

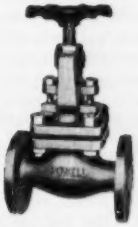


Fig. 1969-NI—150-pound Nickel O. S. & Y. Gate Valve. These valves, in sizes 1½" and smaller, have been modified and are now available with face to face dimension conforming to M.SS SP 42 Standard. Sizes 2" and larger conform to A. S. A. B16 10 Standard.

Fig. 375—200-pound Bronze Gate Valve. Screwed ends, union bonnet, inside screw rising stem and renewable "Powellium" wear-resisting nickel-bronze disc.

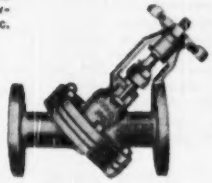


Fig. 1097-AL— Aluminum "Y" Valve with Separable Body, Reversible Seat, flanged ends, outside screw rising stem and yoke.

"Bell-O-Seal" "Y" Valve—Powell "Bell-O-Seal" Valves are available in Globe, Angle, and "Y" patterns, with screwed, flanged, or welding ends. Designed for handling hazardous fluids and for high vacuum service. Can be furnished in a variety of corrosion-resisting metals and alloys, in sizes ¼" to 12", incl.

***The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant metals and alloys.**

Ask your nearest Distributor—or write direct

The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

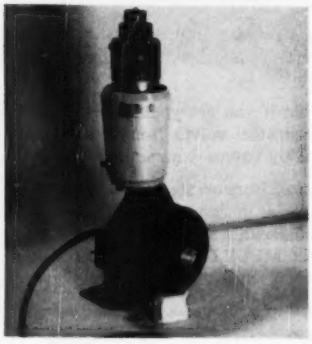
POWELL VALVES

or away from each other. It will accommodate standard motors from 1⅛ to 40 hp. with motor speeds from 900 to 1800 rpm.

Pneumatic Current Controller

Converts pneumatic to electrical control.

Cono Model "EB" pneumatic current controller was developed by the Conoflow Corp., 2100 Arch St., Phila. 3, Pa., to permit use of standard industrial pneumatic controllers on ap-



plications involving electrical components as the final controlled element.

These assemblies can be used in control systems for the ultimate control of temperature, flow, speed, pH, etc. Among their principal uses would be temperature control of electric furnaces and drying ovens, temperature control on electrically heated stills and columns.

The Cono Model "EB" utilizes a standard electrical component modified for continuous throttling control service, and the new Cono pneumatic cylinder operator which includes an integrally mounted positioning device to provide accuracy and sensitivity of positioning to within 1/500 part of its total travel.

Photochemical Lamps

New lamps produce more ultraviolet light than predecessors.

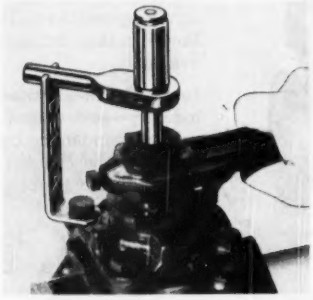
Three new lamps for use in photochemical processes are available from the Westinghouse Lamp Division, Bloomfield, N. J. Designed to emit a maximum of energy in the commonly-utilized wavelengths near 3650 Angstrom units, the lamps are suitable for applications such as the chlorination of hydrocarbons, bromination, hydrogenation, polymerization, decomposition, and many other industrial photochemical processes.

The type C-H9 lamp, rated at 3-kw, produces about 50 per cent more ultraviolet light at 3650 Angstroms than its predecessor, the B-H9. Most of this gain results from the use of Vycor glass, which not only passes a greater portion of the ultraviolet, but which is more heat resistant than the glass previously used. The C-H9 operates at 535 volts and 6.1 amperes, with a starting current of 9.3 amperes. It has an average rated life of 2,000 hours, is 56 inches long, and can be burned in any position.

The type A-H14 is a smaller version of the C-H9 and is rated at 940 watts. It operates at 250 volts, 4.2 amperes, with a starting current of 9 amperes. Length is slightly over 21 inches. It has the same life rating as the C-H9.

The type A-H13 is a 1,200-watt lamp that operates at 125 volts and 10.5 amperes, with a 13-ampere starting current. Its rated average life is 1,000 hours.

Plug Valve Lubricator



This new automatic plug valve lubricator made by Delta Engineering Sales Co., Box 678, Shreveport, La., forces a measured amount of lubricant into the lubricating channels of the valve each time the valve is opened and closed. It fits any make of lubricated plug valve from ½" to 20" in size, requires no alteration in the valve. The valve may be opened and closed 50 to 100 times before the reservoir must be refilled.

• A quick disconnect **coupling** in a 6 inch pipe size for heavy duty applications is a new development of Roylyn, Inc., 718 W. Wilson Ave., Glendale, Calif. This new coupling, the 1700 Series, is operated without tools. Dimensions between flanges is 7"; weight, 17½ pounds. The coupling is rated at 150 psi. A 40° turn will make or break the coupling.

The quick disconnect principle employed is the same used in Roylyn couplings.

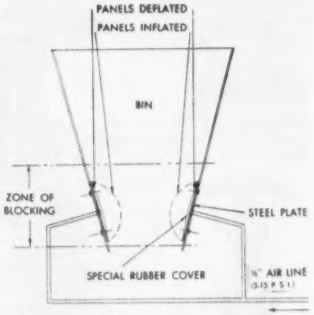
• The F. J. Stokes Machine Co., 5900 Tabor Rd., Philadelphia 20, Pa., has added an improved model, No. 276-C, in their line of **high vacuum McLeod gages.** The new indicating gage has a range from 50 microns down to .01 microns.

The new design permits readings in approximately ten seconds as compared to the older types of indicating gages which required 2 minutes to read. A frosted capillary prevents the mercury from sticking during the tilting operation when readings are required.

Bin Feed Problem Solved

Pulsating panels maintain flow in bins and hoppers.

A new solution to the problem of feeding stubborn materials through bins and hoppers is provided by the PneuBin, a pneumatic device manu-



factured by the Gerotor May Corp., Dept. E, Baltimore 3, Md.

Pulsating PneuBin panels, strategically mounted on the inside walls of bins or hoppers, keep materials moving by positive displacement, thus preventing arching, funneling and tunneling. Flexible covers for the panels are made of reinforced rubber. Air flow to and from the panels is automatically regulated by the PneuBin "Pulsatrol" unit, permitting selection of a wide range of pulsation frequency, force and amplitude.

• A new extremely flexible and lightweight **suction and discharge hose** specifically designed to handle lightweight, loose materials is announced by The B. F. Goodrich Co., Akron, Ohio. The hose is one-ply, wire reinforced, smooth bore, and is manufactured in lengths up to 15 ft. in from 6 to 14 in. inside diameters.

• Heat resistant **nickel-clad copper wires** which provide the good electrical conductivity of copper combined with the heat and corrosion resistant properties of nickel have been announced by Sylvania Electric Products Inc., Warren, Pa. Diameters range from .010" to .005".

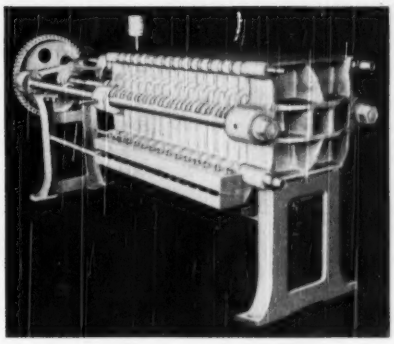
• A new **"wet water" capsule** for on-the-line treatment of ordinary water or sea water to increase its effectiveness in putting out fires has been announced by Aquadyne Corp., 220 E. 42nd St., New York 17, N. Y. The capsule is a

Any filterable mixture handled efficiently at lowest cost

SPERRY FILTER PRESSES

The plate filter press . . . the Sperry filter press . . . is standard equipment wherever filtration is required. These are the reasons why:

Any filterable mixture, including viscous, may be processed.



The filtrate is of maximum clarity.
The cake is drier.
The cake is delivered in slab form.
The cake is thoroughly washed.
The simplest filter cloths may be used.
Paper or pulp may be used as the medium.
Precise temperatures may be held.
Hot liquids do not vaporize.
It is easily constructed of acid or alkali resistant materials.
First cost is low.
Labor cost for operation is low.
The least floor space and headroom is required.
Weight per square foot is no greater than other types of filters.
Depreciation is low.
Filtration may be carried out at low, medium or high pressures.
Resale value is high because of wide use.
Liquid being filtered need not be exposed to atmosphere.
May be used to separate emulsions.
Easily erected by unskilled labor.
May be transported in small pieces.
Will deliver filtrate to higher level than filter.
May use wire, wool, nylon, glass, vinyon and other filter cloths.
May use filter paper.
May be furnished in leak-proof construction.

For the application of these advantages to your own filtration problem, call on Sperry today! An analysis of your problem, together with recommendations for its most efficient solution at lowest cost, places you under no obligation.

D. R. SPERRY & COMPANY
BATAVIA, ILLINOIS
Filtration Engineers for Over 50 Years

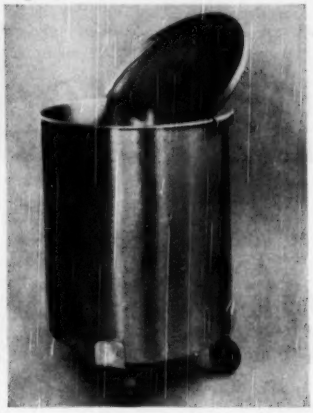
Eastern Sales Representative:
H. E. Jacoby, M.E., 205 E. 42nd St.
New York 17, N. Y.
Phone: Murray Hill 4-3518

SPERRY FILTER PRESSES

Western Sales Representative:
B. M. Pilhashy,
833 Merchants Exchange Bldg.
San Francisco 4, Calif.,
Phone: DO 2-0375

solid composition weighing three pounds and containing highly concentrated active blends of wetting elements especially selected for fighting fires. It is multiphase and instantly miscible with water through a wide pH range.

Ingredient Container



A portable "ingredient container" of all-welded stainless steel or aluminum construction for in-plant use is announced by Glengarry Processes, Inc., Bay Shore, N. Y. The container is offered for uses where portable storage under sanitary, corrosion proof, and rodent proof conditions is required.

• Filtrine Manufacturing Co., 53 Lexington Ave., Brooklyn 5, N. Y., have introduced a new line of **explosion proof electric drinking fountains** built to comply with requirements for hazardous locations, with capacities ranging from 10 to 40 gallons per hour.

• An entirely new type of **"electric eye"**—smaller and allegedly sturdier than present photo-electric cells and possibly cheaper—has been invented by Bell Telephone Laboratories, New York 14, N. Y. Called the phototransistor, the entire device is housed in a cylinder the size of a .22 calibre rifle cartridge.

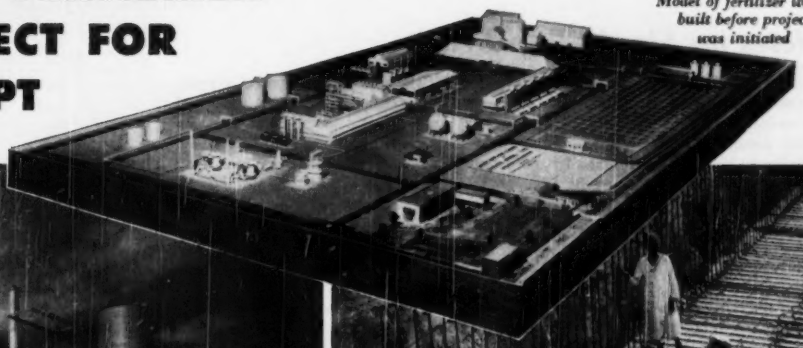
• A new line of Flo-Scopes—**flow rate indicators** for air and gas—is announced by Selas Corporation of America, Philadelphia 34, Pa.

• The use of **ball-point pens** for electronic strip chart recorders is announced by Minneapolis-Honeywell Regulator Co., Philadelphia 44. The pen is being recommended where measurements demand rapid pen movements across the instrument chart.

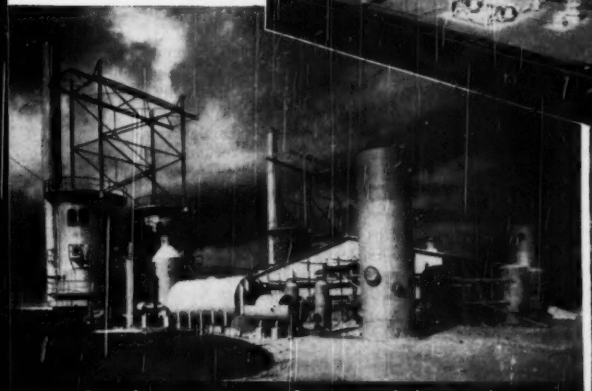
• A new extruded translucent **plastic** tubing is announced by Carter Products Corp., 10193 Meech Ave., Cleveland 5, Ohio.

Progress Report by Chemico

LARGE FERTILIZER PROJECT FOR EGYPT



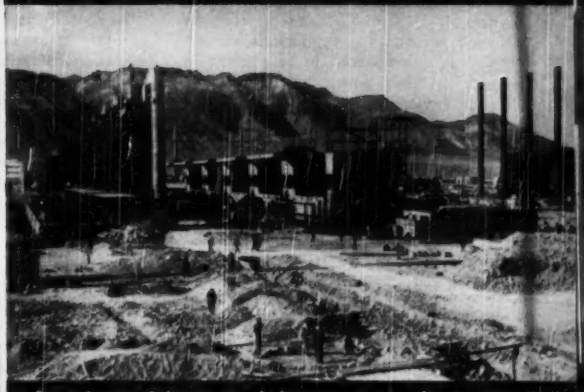
Model of fertilizer works built before project was initiated



Gas reformers to convert refinery gas to hydrogen and nitrogen

Local craftsmen placing reinforcing steel for foundations

Nitric acid absorption towers and ammonia storage tanks



General view of the project which covers an area of 1350 acres

These photographs show work in progress on the 550-ton per day fertilizer plant being built at Suez, Egypt. This important Chemico project includes plants for the production of synthetic ammonia, nitric acid and calcium nitrate together with complete facilities for supplying utilities such as power and water to the various units. This is one of a number of world-wide Chemico activities which include projects in Formosa, India, Mexico, South Africa and Brazil. Whatever your problem may be in the production of heavy chemicals ... wherever it may be ... you can be sure that Chemico will deliver a highly efficient plant on a guaranteed-performance basis.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

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CYANAMID PRODUCTS, LTD., BRETTENHAM HOUSE, LANCASTER PLACE, LONDON W. C. 2 ENGLAND
EUROPEAN LICENSEE OF N. E. C. PROCESS
HYDRO-NITRO S. A., 8 QUAI DU CHEVAL BLANC, GENEVA, SWITZERLAND • CABLES: CHEMCONST, NEW YORK

Chemico Plants are Profitable Investments

CC 197

PACKAGING & SHIPPING

by T. PAT CALLAHAN

Notes on Single-Trip Drums

I. C. C. SPECIFICATION metal drums of the returnable type for hazardous materials shipped in interstate commerce have been discussed previously in this department. In addition to the returnable type drum there are also specification drums commonly referred to as non-returnable drums. A brief outline of these non-returnable drum specifications follow:

All single-trip I. C. C. specification drums are included in the I. C. C. specification 17 or 37 series.

I. C. C. 17C may be constructed of 16 gauge material for the 55-gallon to 22 gauge material for the 5-gallon size. Commonly used in the 55-gallon size, this container is of more sturdy construction than the conventional I. C. C. 17E drum and is specified for certain very hazardous materials such as carbon bisulfide. For example, if over 5 gallons of carbon bisulfide were to be shipped in a metal drum single-trip, I. C. C. 17C would have to be used because the regulations do not permit this material to be shipped in a 17E drum which has a capacity over 5 gallons.

17E Most Used

I. C. C. 17E is the most commonly used single-trip container. This container may be constructed up to 55 gallons in size and may be constructed from 18 gauge for the 55-gallon size to 24 gauge for the 5-gallon size. However, in the 30-gallon size 19 gauge or 20 gauge is permitted for both body and head sheets and in the 55-gallon size 20 gauge is permitted for the body sheet only. This container is authorized for the great bulk of inflammable materials shipped in interstate commerce and is also used extensively for the shipment of poisonous liquids and poisonous solids. This drum differs from the ordinary Rule 40 steel container in that the heads of the I. C. C. 17E drum must be convex (crowned). It must be particularly noted that Rule 40 drums are not permissible for hazardous materials and the I. C. C. 17E drum must be used in place of the Rule 40 if the material is of a hazardous nature.

I. C. C. 17F drum is a drum constructed of 55-gallon capacity generally with body and head sheets of 16 gauge. This I. C. C. 17F drum may be used as a single-trip container for sulfuric acid of 1.7059 specific gravity (60° Baume tolerance plus .2° Baume); or acid of greater strength with or without inhibiter, provided such acid has a corrosive effect on steel measured at 100° F. no greater than 66° Baume commercial sulfuric acid. Drums equipped with vented closures of an experimental type approved by the Bureau of Explosives are also authorized for export shipments. This drum allows a lighter drum for sulfuric acid for export than the conventional I. C. C. 5A drum.

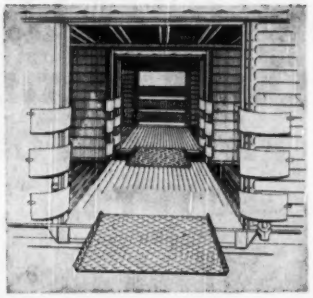
I. C. C. 17H may be constructed of 18 gauge for the 55-gallon size to 24 gauge for the 5-gallon size. However, this type of container has a removable head and the head sheets range from 14 to 20 gauge depending upon the size of the drum. This drum is usually specified for certain hazardous materials, such as inflammable solids and oxidizing materials, poisonous solids and certain viscous inflammable liquids. It is well to check the Interstate Commerce Commission Regulations pertaining to the use of the I. C. C. 17H drum for any inflammable liquids as this drum may be used for certain inflammable liquids which flash between 80° F. and 20° F. but may not be used for inflammable liquids which flash 20° F. or below.

I.C.C. 17X is a light gauge single-trip drum which is generally manufactured in 30 and 55 gallon sizes to be used for export shipments only of inflammable liquids for shipment via common carriers by water to non-contiguous territories or possessions of the United States and foreign countries; shipments from inland points in the United States which are consigned to such destinations are authorized to be transported to ship side by rail freight in carload lots only and by motor vehicle in truckload lots only.

This discussion of single-trip metal drums I.C.C. 37 series will be continued in a subsequent issue.

Retaining Strips Provide Walk-In Feature

Duplex retaining strips, developed by Signode Steel Strapping Co. as a companion unit to its one-piece retaining strips, recently have been made available to shippers. Thoroughly field tested, these retaining strips not only protect the lading, but also make the



loading of packaged commodities quicker and easier. Many large shippers already report unusually good results.

In the use of the Duplex retaining strips, the procedure recommended by Signode is to brace the off door of the farther car with regular retaining strips. The new Duplex retaining strips are then applied to all other doors, leaving enough slack to permit them to be severed down the center and finally resealed.

Stable Prices Seen for Containers in 1950

The Spring, 1950, Quarterly Industry Report on Containers and Packaging issued by the Office of Domestic Commerce, United States Department of Commerce, Washington 25, D. C., has the following outlook on containers and packaging:

"During 1949 American businessmen gave more attention to packaging than probably at any time in the history of this country. During the past decade packaging has become generally recognized as an important segment of, and contributor to, the national economy. Of course, like transportation, packaging is the beneficiary of accelerated industrial activity, but good packaging is also an excellent sale producer. Most merchandise is packaged at one time or another; consequently, packaging as a cost reducer and as a silent salesman, is a growing factor in successful business operation.

"In recognition of packaging's role in the economic scheme, manufacturers, distributors, and retailers have planned merchandising programs for 1950 which will capitalize on the effect of imaginative and colorful packaging as stimuli to impulse sales. The original function of containers, the maximum protection of contents at the minimum cost, is, of course, not forgotten. While such programs will accent display impact, experience has shown that the protective and utilitarian quality of the packaging cannot be sacrificed if repeat sales and long gains are to be achieved.

"With competition accelerating, and

The Shield that Protects your Product

. . . AND YOUR POCKETBOOK !

If you have been using space-taking, weight-wasting containers for your "hard-to-package" foods or chemicals—learn what St. Regis Multiwall Paper Bags with Polyethylene-coated ply* are doing to cut costs and solve packaging difficulties for many manufacturers.

Savings range up to 46 cents per cwt. packed. *Not* just in the lower price of Multiwalls, *but* also through big economies in storage cost, in freight charges, in tare-weight, and in packing costs.

St. Regis Multiwalls with Polyethylene-coated ply protect your product. They are highly resistant to moisture . . . acids . . . alkalies . . . greases . . . and alcohol. The plastic coating on an inner layer of the kraft paper is non-toxic, inert, odorless—and *strengthens* the bag itself!

PLYOLENE—
the St. Regis name for Polyethylene Multiwall Paper Bag

For full information on what St. Regis Polyethylene-coated ply Multiwalls can do to solve your packaging problems and cut your container costs—write your nearest St. Regis Sales Office, stating the nature of your product.

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YOU BUY PROTECTION WHEN YOU BUY MULTIWALLS

with packaging supplies in abundance almost without exception, raw material prices in most categories of containers eased during 1949. The close of 1949 found these downward price trends arrested and 1950 prices are expected to remain reasonably stable. This should be conducive to longer term buying thereby achieving savings in costs at almost all levels. Obviously if such be the case container producers will be able to operate on a much more stable basis than during 1949. Therefore, 1950 holds definite assurance that the entire packaging field with reaffirmed confidence can continue to progress as it has during the last few years."

Extension for Reuse of Single-Trip Containers

The Bureau of Explosives has extended from March 31, 1950, to August 31, 1950, its cancellation of all existing authorizations for reuse of single-trip containers for regulatory materials.

FDA States Label Policy On Antibiotics for Export

The Food and Drug Administrator of the Federal Security Agency has issued a statement of general policy or interpretation upon labeling antibiotic and antibiotic-containing drugs sold to persons engaged in export trade. This statement of general policy or interpretation is very important to shippers of these materials and is quoted below as issued by the Administrator:

TITLE 21—FOOD AND DRUGS
CHAPTER I—FOOD AND DRUG ADMINISTRATION, FEDERAL SECURITY AGENCY

Part 3—Statements of General Policy or Interpretation

Antibiotic and Antibiotic-Containing Drugs Sold to Persons Engaged in Export Trade

Pursuant to sections 3 of the Administrative Procedure Act (60 Stat. 237, 238; 5 U.S.C. 1002), the following statement of interpretation is issued:

Sec. 3.15—**Notice to manufacturers and labelers of antibiotic and antibiotic-containing drugs.** Recent investigations by the Federal Security Agency have revealed that a number of persons engaged in manufacturing and selling antibiotic and antibiotic-containing drugs are introducing into interstate commerce shipments of these drugs that are unlabeled, or not fully labeled, and are not exempt from labeling under the provisions of 21 CFR 146.18. This practice has been based upon the belief that interstate shipments of antibiotic and antibiotic-containing drugs to persons engaged in the export trade are not subject to certification.

When these drugs are introduced into interstate commerce they must be certified, exempted from labeling under par. 146.18, of this chapter, or exempted from misbranding by meeting all the conditions specified in section 801 (d) of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 381 (d)). Section 801 (d) of the act is not satisfied merely by shipment of drugs to exporters. If exemption under this section is to be claimed, the drugs, at the time of introduction into interstate commerce, must be marked for export, must accord to the specifications of the foreign purchaser, and must not be in conflict with the laws of the country to which they are intended for export. The initial shipper has a responsibility to meet all the conditions of section 801 (d) if exemption is to be claimed. It is not enough that he is shipping to a person engaged in the export trade who will obtain a foreign purchaser, who will mark the goods for export, and who will obtain assurance that the drug is not in conflict with the laws of the country to which it is intended for export.

Section 146.18 of this chapter provides exemption from labeling. If the original shipper has an effective exemption permit under these regulations, the exporting firm named in the exemption permit may be allowed to receive and to hold the unlabeled drugs under the exemption until the conditions of section 801 (d) of the act are satisfied.

(Sec. 701, 52 Stat. 1055; 21 U.S.C. 371)

Dated: March 3, 1950.

OSCAR R. EWING,
Administrator.

(Seal)

CELANESE

Your new source for

PROPYLENE GLYCOL
DIPROPYLENE GLYCOL
PROPYLENE OXIDE

These versatile chemicals are now available from Celanese. They comprise the latest group to be added to the growing list of petrochemicals now being produced at the Celanese Chemcel plant near Bishop, Texas. Specification bulletins, prices and samples available on request. Celanese Corporation of America, Chemical Division, Dept. 52-E, 180 Madison Avenue, New York 16.

DID YOU KNOW...

that Celanese can supply raw materials for both alcohol and permanent type anti-freeze... brake fluids... hydraulic fluids... lubricant additives? Write for brochure containing detailed information about the complete line of Celanese* organic chemicals.

Celanese* CHEMICALS

*Reg. U. S. Pat. Off.

ALCOHOLS · ALDEHYDES · GLYCOLS · INTERMEDIATES · KETONES · PLASTICIZERS · SOLVENTS

Gummed Industries Manual

The Gummed Industries Association, Inc., 19 West 44th Street, New York 18, New York, publishes industry's instruction manual, "What Every Shipper Should Know About Proper Package Sealing," also the "see-at-a-glance" Wall Chart which shows how to "Seal It Right with Gummed Tape." There are many good suggestions in these data for the shipper. This information may be procured by writing to the above association.

Pneumatic Scale Acquires Vacuflow Fillers

Vacuflow Filling Machines for powdered material formerly manufactured by the Mechanical Division of General Mills, Inc., Minneapolis, Minn., have been acquired by the Pneumatic Scale Corp., Ltd., Quincy, Mass. Production of these machines will be resumed by Pneumatic.

This group of machines is made up of several rotary and single head units for filling freeflowing and non-freeflowing materials at speeds ranging up to 300 per minute. All models operate on the same basic principle of vacuum filling, which allows accurate, dust free handling of products. Units are equipped with pneumatic (air controlled) container lift plates and have automatic safety shutoffs.

Versatile Tying Machines

The Bunn Package Tying Machines come in many different sizes and models for tying any and all

sizes and weights of bundles. The multiple of wraps varies from one to four and the weight and strength varies from very light to 24-ply soft cotton and jute. Bundle sizes range up to 40 inches in height. This machine is mobile and can be easily moved by one person to any part of the plant. It has many uses and can be obtained from B. H. Bunn Co., 7605 Vincennes Avenue, Chicago 20, Ill.

Packaging Institute Forum

The date of the Twelfth Annual Forum of the Packaging Institute was announced as October 23-25, at the Hotel Commodore, New York, by Charles L. Barr, President of the Association, at a recent meeting of its executive committee. Coming midway between the end of the seasonal crop harvest and the rush of preparations for the holiday trade, Mr. Barr predicts a greater interest than ever before in the seminar discussions of the problems of packaging on the production line.

High Capacity Fork Truck Features New Drive

A 10,000-pound capacity fork-lift truck, gasoline powered and equipped with the Dynatork Drive, has been added to the line of the Industrial Truck Division of Clark Equipment Co., Battle Creek, Mich. The new model is known as the Utilitruc-100.

The Dynatork Drive will be standard

the call for MULTIWALL is the call for FULTON

Fulton is now a recognized factor in the manufacture of quality Multiwall Paper Bags. Orders received from the largest users in many industries have been executed to the complete satisfaction of the buyers.

We are very proud of the confidence shown in our company by those who have favored us with orders for bags. We will spare no effort to continue producing the kind of bags that will keep these names on our books for many years to come.

Our new modern plant in New Orleans is equipped to produce all types of Multiwall Paper Bags. Give us a call on your next order.

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Atlanta • St. Louis • Dallas • Kansas City, Kans.
Denver • Minneapolis • New Orleans
Los Angeles • New York City

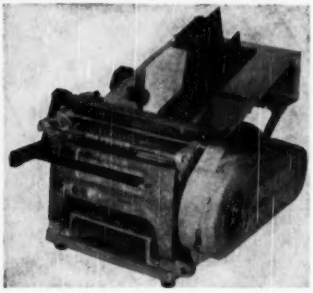
FULTON MAKES YOUR STYLE MULTIWALL PAPER BAG:

SEWN VALVE WITH TUCK-IN SLEEVE . . . SEWN VALVE . . . SEWN VALVE WITH L.C. SLEEVE . . .
PASTED VALVE . . . PASTED OPEN-MOUTH . . . SEWN OPEN-MOUTH

equipment on the new truck, and the only type of drive available. It transmits engine power through a magnetic field, across an air gap, eliminating need for any type of friction clutch. The conventional transmission is also eliminated, and replaced by constant-mesh forward-and-reverse gearing.

New Label Paster Has Semi-Automatic Feed

A light touch on a rod delivers a glued label to an operator on the new Semi-automatic Feed Label Paster of



Potdevin Machine Co., 1285 38th St., Brooklyn 18, N. Y. Ungummed labels are stacked in an adjustable hopper, accommodating labels up to 5½ inches wide. The operator's hands are positioned to receive the label; touching the feed actuator with the back of either hand causes one label to be fed through the machine automatically. The label picks up a coating of adhesive and is delivered to the operator's fingertips.

The amount of adhesive applied to the label is controlled by a dial regulator.

Sturdily constructed, the paster measures 7¾ inches wide x 11⅛ inches long. Equipped with a 1/20 H.P. motor.

The semi-automatic feed can be furnished as an attachment to Potdevin machines already in use.

Diamond Changes Package For Dairy Cleaners

Newly improved and redesigned "double-duty" containers have been adopted and standardized by Diamond Alkali Co., Cleveland, for packaging its two specialized dairy farm detergents, "All-Purpose W Cleaner" and "Clipper Cleaner."

All-Purpose W Cleaner is now packaged in 5-lb. and 10-lb. cans, which have metal tops and bottoms with thick, specially-treated fibre sidewalls and lacquered label to resist dampness. It is designed in red, white and blue color bands for instant recognition and identification by the user.

This cleaning compound also is packaged in 4-lb. cardboard cartons.

American Can in New York moves to 100 Park Avenue

On May 1st, after many years at 230 Park Avenue, we occupy a beautiful new home in one of the world's most modern office buildings, 100 Park Avenue, at 41st Street.

Come and see us

Come by train . . . we're just 1 block south of Grand Central Terminal! Come by plane . . . the airlines terminal is just around the corner! Subway is across the street. Close at hand are America's best-known shops and hotels.

We cordially invite all our friends to visit our new quarters. Don't let the weather stop you; the building is air-conditioned throughout . . . even the sidewalks are steam-heated . . . to keep them clear of snow and ice.

Our telephone number (and the warmth of our welcome) remain the same. Telephone: MUrray Hill 6-4900.

AMERICAN CANCO CAN CO.

PLANT OPERATIONS NOTEBOOK

Freezing and Overheating of Process Lines Stopped

Bare process lines prevented from freezing or overheating by insulated steam line within one overall covering.

At the Niagara Falls plant of the Stauffer Chemical Co. mineral wool insulation simultaneously guards against freezing and overheating in process lines. Further, steam line heat losses are also controlled.

A parallel steam line is usually used to prevent an outdoor process line from freezing, the process line and the steam line being insulated within one insulation covering. However, when Stauffer planned to use a 340 F steam line to heat a caustic soda line and a compressed air line, it was found that the two process lines would be overheated.

This problem was solved by insulating the steam line to a thickness which would permit escape of only enough heat to prevent freezing of the caustic soda and moisture in the compressed air. To do this an overall covering of mineral wool was used for the pipe-trio. Further, the steam line was sufficiently insulated by the double layer to prevent heat from wasting to the atmosphere. Overheating of the process lines during the summer was also prevented by this insulation-within-insulation technique.

The technique used is indicated in the cross-sectional drawing. After removing grease and dust from the 300′ pipes, 1″ molded sectional pipe insulation is applied over the entire surface of the 2″ steam pipe. The sections are tightly butted together and held in place by metal bands.

Mineral wool blankets are then sandwiched between facings of wire mesh to be cut and shaped and wired in place with 16-gauge galvanized wire. Wire of this same size is also used to lace together the abutting edges and ends of the blankets. The outdoor installation is completed by wrapping asphaltic roofing felt around the entire surface. The felt is lapped 3″ against the weather and bound on 6″ centers by galvanized wires.

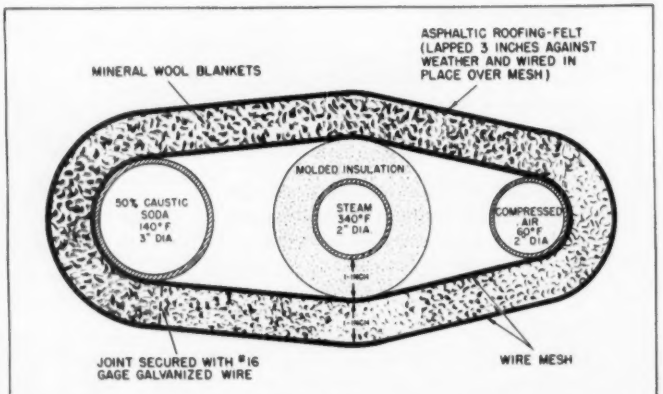
Don't Neutralize Acid Burns

The National Safety Council warns against the not uncommon practice of keeping alkaline solutions on hand for treating burns from acid. Sodium bicarbonate solution is a remedy favored by many.

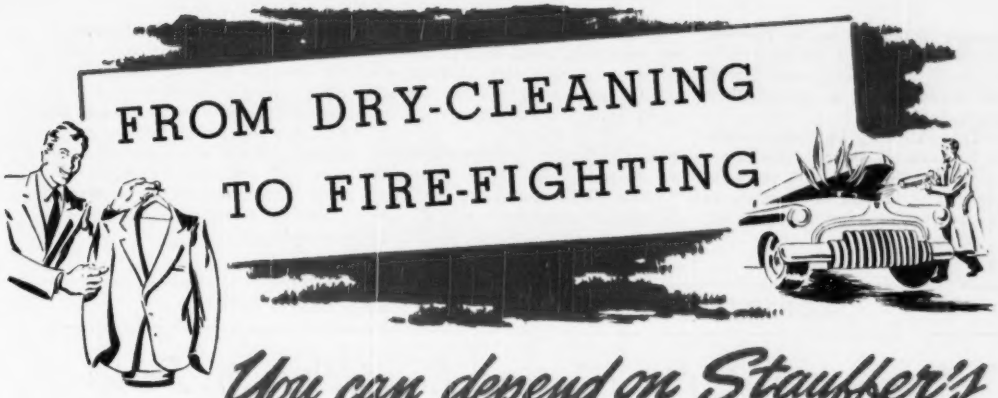
The use of neutralizing solutions for burns is not recommended because they often increase the severity of the injury. Personnel who handle corrosive materials should be instructed to wash thoroughly with plenty of water if the material comes in contact with the skin, and to report to the plant health department for treatment. Have you checked this condition in your plant lately?

Use of Solvents in Low Places

Because they are heavier than air, solvent vapors have a tendency to collect at floor level and in the bottoms of tanks and pits. To be on the safe side, follow these rules where it is



INSULATION-WITHIN-INSULATION ON PARALLEL OUTDOOR PIPE LINES



You can depend on Stauffer's

Carbon Tetrachloride 99.99%

Stauffer's Carbon Tetrachloride is especially suitable for the dry-cleaning industry because of its high purity which assures quality odorless cleaning. Many fire extinguishers of the hand pump or bomb type use Stauffer's Carbon Tetrachloride as the extinguisher fluid since the vapor in even small amounts snuffs out the flame while the liquid itself is a non-conductor of electricity and cannot cause a short or spread the fire.

Throughout industry, Stauffer's Carbon Tetrachloride is used widely for degreasing, as a fumigant, and in chemical syntheses, for example, the refrigerant Freon. Write today for our comprehensive booklet on the properties and uses of Carbon Tetrachloride.

GRADES

Technical and C.P.

ANALYSIS

Boiling Range	75.8—77.0°C.
Moisture	No apparent reaction with sodium
Acidity	Neutral to methyl red
Free Halogens	Nil

	Technical	C.P.
Non-volatile matter not more than	0.0015%	0.0005%
Carbon Bisulphide content not more than	0.050%	0.005%

OTHER STAUFFER PRODUCTS

BHC (Benzene Hexachloride)
Borax
Boric Acid
Boron Trichloride
Carbon Bisulphide
Carbon Tetrachloride
Caustic Soda
Chlordane
Chlorine
Citric Acid
DDT (Dichloro Diphenyl Trichloroethane)
Silicon Tetrachloride
Sodium Hydrosulphide
Sulphur—Soluble (Specially processed for all industrial and agricultural uses)
Sulphur—Insoluble (For rubber compounding and other uses)
Sulphur Chloride
Sulphuric Acid
Tartaric Acid
Textile Stripper
Titanium Tetrachloride
Toxaphene (Chlorinated, Camphene)
2,4-D (Acid Isopropyl Ester, Amine Salts)

Stauffer CHEMICALS SINCE 1885

STAUFFER CHEMICAL CO.

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424 Ohio Bldg., Akron 8, O. · Apopka, Fla. · N. Portland, Ore. · Houston 2, Tex. · Weslaco, Tex.

necessary that workmen be exposed:

1. Anyone assigned to work with solvent in an enclosed space should wear a supplied-air or self-contained oxygen respirator.

2. When cleaning with solvent, provide as much ventilation as possible.

3. When solvent is used for brief cleaning jobs, instruct workman not to bend over the work and avoid inhaling the vapors.

4. Watch for early symptoms of vapor poisoning, which includes nausea, dizziness, headache, fatigue. If they occur, the man should seek fresh air immediately.

• A new **feeder** for laboratory operations is available from %Proportioneers, Inc.%, Providence, R. I. The Micro-Feeder injects a smooth, uninterrupted flow through a capillary tube and injection needle. Capacity of standard unit is 100 cc. with feeding rates as low as 1 cc. per hr. Either change gears or variable speed drives are available to provide constant rate or flow proportional feeding. A synchronous 110-V AC motor drives the unit and automatically stops when limit of plunger travel is reached. Signal light and four-figure totalizer are included.

NOMOGRAPH-OF-THE-MONTH Edited by DALE S. DAVIS

Nomograph for Binary Equilibrium Data

JU CHIN CHU,[1] W. D. ROBINSON[2] and D. P. DOLL,[3] Washington University, St. Louis, Missouri

BASED on the definition of relative volatility, the vapor-liquid equilibrium relationship for a binary system can be represented by:

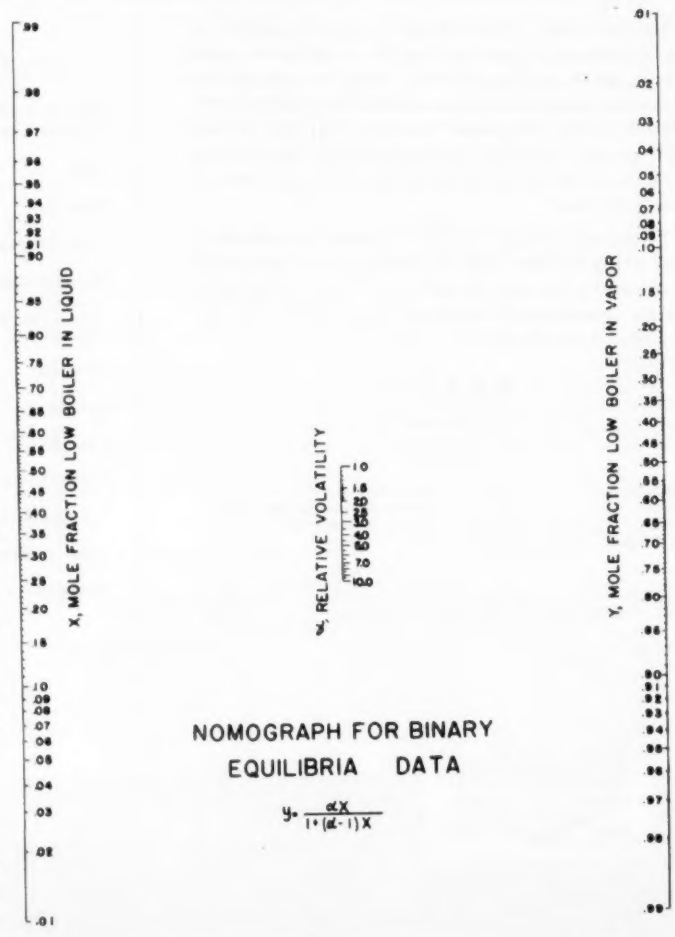
$$y = \frac{\alpha x}{1 + (\alpha - 1)x} \qquad (1)$$

where α = relative volatility
x = mole fraction of the low boiler in the liquid
y = mole fraction of the same component in the vapor which is in equilibrium with the liquid.

As no other assumptions than a binary system have been made, Equation 1 can be applied to nonideal as well as ideal binary solutions.[1] In the case of ideal solutions, the relative volatility changes very little, or varies linearly with the temperature. For the convenience of the calculation, α for the ideal solution can be assumed constant at an average value. In the case of nonideal solutions relative volatility is not a constant, but a function of the concentration of a system.

The calculation of vapor-liquid equilibrium composition from Equation 1 is extremely important in the design calculation of distillation. Where a large number of calculations has to be made, it is desirable to have a nomograph as presented here to save time in calculation.

With mole fraction of low boiler in liquid and relative volatility of a system given, the mole fraction of the same component in the vapor which is in equilibrium with the liquid can be located on the extension of the line connecting values of x and α. Conversely, if y and α are given, x must be the intersecting point of its scale with the extension of the line connecting α and x.



Literature Cited

1. Chu, J. C., Chem. Eng. Progress, *44*, 721 (1949).

[1] Present address, Polytechnic Institute of Brooklyn, Brooklyn 2, N. Y.
[2] Present address, Monsanto Chemical Co., St. Louis, Mo.
[3] Present address, National Lead Co., St. Louis, Mo.

LABORATORY NOTEBOOK

Dialysis

Regenerated cellulose sausage casing available for dialysis experiments.

Regenerated cellulose sausage casing has been found very satisfactory as a dialysis membrane. Being a continuous length seamless tube, without macroscopic porosity, it is particularly convenient for fabrication of moderate sized dialysis setups.

To make this material readily available for educational and scientific purposes, the Special Products Div. of The Transparent Package Co., 3520 Morgan St., Chicago 9, Ill., will supply limited quantities of regenerated cellulose sausage casing tubing free of charge to educational institutions and research laboratories. This tubing will be available in twenty-five foot lengths of dry tubing, wound on cardboard spools, or in fifteen-foot lengths of gel tubing in glass jars, packed in water containing a trace of preservative to prevent spoilage. The gel tubing retains its original uncollapsed structure and has a somewhat higher permeability than dried and rewet tubing. The diameter of both gel and rewet tubing is approximately one inch. Wall thickness is about .001".

Balance Scoop and Counterweight

New aluminum scoop and counterweight eliminate weighing errors caused by air buoyancy.

The Ohaus Scale Corp., 10-14 Hobson St., Newark, N. J., is producing a new analytical balance scoop and counterweight, both made of aluminum, to eliminate buoyancy errors due to air density variations. These scoops are available in both 10 and 30 ml. sizes.

These sets are precisely balanced for use in the finest analytical work and are unaffected by air density changes.

Electric Oven

New oven reduces temperature differentials by forced draft.

The new forced draft, electric oven of Electric Hotpack Co., Cottman Ave. at Melrose St., Philadelphia 35, Pa., is thermostatically controlled from 35°C, to 200°C, 1°C differential.

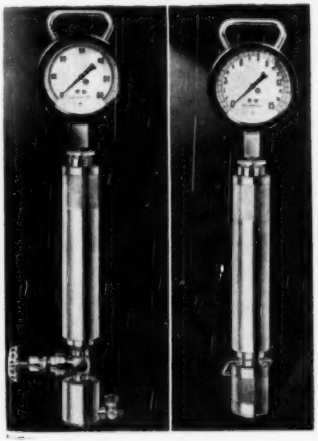
The type of material or the positioning of the materials to be dried in gravity convected ovens cause differentials between the top and bottom of the working chamber, often varying 5-20°C. Hotpack has developed a new type of heat convection, by agitating the heated air and channeling it in a uniform pattern throughout the oven, so that heavy masses or over-loading will not cause hot air pockets and it thereby permits use of the whole working chamber from floor to ceiling.

Convection is developed by the blower located in the rear wall of the oven. The blower system circulates the air horizontally across the shelves to the front and is returned along the side walls, back to the blower.

Vapor Pressure Bombs

Light weight vapor pressure bombs simplify aviation gasoline testing.

Precision Scientific Co., Chicago, has developed light weight Reid vapor pressure bombs suitable for testing aviation gasolines according to the revised A.S.T.M. Method D-353-49. These Reid bombs are also suitable for ordinary



gasoline, benzol blends and volatile liquids. The volume ratio of the air chamber has been held within the close limits set for testing aviation gasolines.

Without the pressure gauge the immersion sampling bombs weigh only 3 lbs., the pressure sampling bombs 4½ lbs. Composed entirely of nickel-plated brass, they are made within the tolerances specified in the A.S.T.M. procedure. Ease of manipulation and simplicity are prime advantages. The gauge is sealed in place by turning a special coupling furnished; thus, strain on the gauge is released.

Precision Bourden-type Reid gauges are guaranteed accurate to within 0.5% of the scale range, have stainless steel mechanism.

The immersion sampling bomb is 15" high by 2" in diameter; the pressure sampling bomb is 16½" high by 8" through the valves by 2" diameter.

3 groups of money-saving dark resins

adequate in range and use

	DESCRIPTION	USES
PARADENE #1, 2, 3, 33, 34 and 35	Melting point from 20° to 130° C. Readily soluble in petroleum and coal-tar (aromatic) solvents.	Used in manufacture of adhesives, concrete curing compounds, electrical insulation, floor tile, linoleum, paints and varnishes, pipe coatings, textile coatings and in compounding of natural and synthetic rubber.
465 RESIN	Melting point—105° to 120° C. Soluble in aromatic solvents and partially in petroleum solvents.	Used in the manufacture of adhesives, box toes, ethyl cellulose lacquers, impregnations, linoleum, floor tile, sealing compounds, varnishes and in the compounding of natural and synthetic rubber.
NUBA #1, 2, 3X	Melting point from 80° to 135° C. Soluble in aromatic solvents. They are cohesive and have high molten viscosity.	Used in the manufacture of adhesives, binders, box toes, briquettes, composition insulating blocks; filling, stiffening, molding and thermal insulating compounds; leather dressings, steep-roof coatings and for compounding natural and synthetic rubber.

Write for samples and booklet describing these resins.

A-32

THE NEVILLE COMPANY
PITTSBURGH 25, PA.
Chemicals for the Nation's Vital Industries

BENZOL • TOLUOL • CRUDE COAL-TAR SOLVENTS • HI-FLASH SOLVENTS
COUMARONE-INDENE RESINS • RUBBER COMPOUNDING MATERIALS • TAR PAINTS
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INDUSTRY'S BOOKSHELF

SURFACE-ACTIVE QUATERNARY AMMONIUM GERMICIDES, *by Carl A. Lawrence,* Academic Press, Inc., New York; 1950; 245 pp., $6.00.

DR. LAWRENCE presents a comprehensive review of quaternary ammonium surface-active germicides to fill the need of investigators in this field. It includes the history, chemistry, biology and applications of the quaternary ammonium salts that have appeared in print to date of publication.

The section on chemistry covers synthesis and ionization, action on metals, compatibilities and incompatibilities, and other essential characteristics. Physical properties are dealt with, as well as the biology of quaternary ammonium germicides. Phenol coefficient, bactericidal tests, influence of pH on antibacterial efficiency, infection-protection tests, fungicidal properties, and inactivation of quaternaries are among topics discussed.

Other sections consider pharmacology and toxicology; and practical applications in surgery and general disinfection. The author also takes up special applications in the textile, laundry, paper and mining industries. A feature of the book is a listing of quaternaries by trade name, chemical name, and distributor or manufacturer. Over 500 references are cited.

MODERN PACKAGING ENCYCLOPEDIA 1950, published by Packaging Catalog Corporation, New York, N. Y.; 931 pp.; $4.00.

THERE IS much new material and a fresh perspective on familiar subjects in the latest edition of Modern Packaging Encyclopedia which has been published annually since 1929. Its editors, who also turn out *Modern Packaging* magazine, report that 63 per cent of the articles are entirely new, and of course, its valuable buyers' directory has been brought up to date along with the discussions of technical developments in the field.

In the section "Packaging Achievements," case histories of at least nineteen different lines of business are given as a guide to manufacturers who may be faced with similar problems. Practical solutions are presented from information and illustrations supplied by the companies involved.

In several important fields particularly adhesives, developing the package, use of package surface and graphic arts processes—round table discussions by experts are the means of presenting the year's advances.

The introductory section contains an alphabetical index, index by industries served, index of package forms, and index of machinery and equipment. The other eight sections cover packaging achievements, package planning, materials of packaging, package forms, machinery and equipment, shipping containers and equipment, display for packaged products, and the buyer's directory.

POLISHES (THEIR RAW MATERIALS & MANUFACTURE), *by J. Davidsohn and A. Davidsohn,* Leonard Hill, Ltd., London; 1949; 175 pp., 15s.

A HANDBOOK for the maker of shoe and floor polishes and related products, this work is designed to be a guide in selecting raw materials and processes of manufacture. It has been enlarged and modernized from the first (1939) edition. The first section treats raw materials for wax foundation, solvents, alkaline raw materials and emulsifying agents. The second describes general manufacture and apparatus; shoe polishes; floor polishes; car, furniture and metal polishes; and some simple analytical tests.

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NEWS OF THE MONTH

New Construction

• **The Dow Chemical Co.'s new plant** at Freeport, Tex., for expanded latex production is progressing rapidly, and will probably be completed by about June 15. It is one of two plants Dow is building for latex coating materials used by paper, textile and paint industries. The Midland latex plant was recently severely damaged by fire, and is now being rebuilt. This, too, is expected to resume operations June 15.

• **A $4 million expansion** and development program in the Polk County (Florida) phosphate fields marks the entry of International Minerals & Chemical Corp. into phosphate chemicals. Principal projects include plans for a new plant to manufacture multiple super-phosphate and phosphate chemicals; a new large sulfuric acid plant; a new analytical laboratory; a new machine shop, warehouse, and service center to serve the company's Florida operations; and a new office building to be located near Bartow.

• **The Ecusta Paper Corp.** will soon construct a new $18 million cellophane plant at Pisgah Forest, N. C. The plant, to be built adjacent to the cigarette company plant at Ecusta near Brevard, N. C., will be built by the Du Pont Co., and is expected to be completed by the spring of 1951.

• **An applied research laboratory**—third unit in B. F. Goodrich Chemical Co.'s multi-million-dollar installation at Avon Lake, Ohio—has just begun. A general chemical plant and experimental station are now in operation. The new unit will be a 1-story building, covering 17,500 sq. ft. and will have separate materials and processing laboratories, a compounding room, Banbury mixing room, controlled temperature test room, offices and conference rooms.

• **A new plasticizer plant** to be built at an estimated cost of $250,000 at Dover, Ohio, by Hardesty Chemical Co., is expected to be in operation by June 1. The contract for design and construction management was just let to R. W. Booker & Associates, St. Louis, Mo.

• **Production of polystyrene plastic molding compounds** is expected about August 1 in a new plant to be constructed at Long Beach, Calif., by Monsanto Chemical Co. This will be the first of its kind on the West Coast and the first major producer of styrene molding powder west of the Mississippi. Monsanto's Western Division which has headquarters in Seattle, Wash., will operate the new plant.

Carl S. Miner (left), director of Miner Laboratories, elected to the board of directors of Commercial Solvents Corp.; and Warren L. Smith, former senior vice-president, elected president of The M. W. Kellogg Co. to succeed Harold R. Austin, who is retiring.

• **Construction has started** on a new $250,000 asphalt blending plant at the Salt Lake refinery of Utah Oil Refining Co. Operations will be associated closely with those of the new $2.5 million propane deasphalting unit which has been on stream for about a year.

• **Continental Carbon Co. and Witco Chemical Co.** have approved immediate construction of four additional high abrasion furnace black units. These will increase fourfold Continental's output of this new furnace black.

• **A 30% increase in manufacturing area** will be available to Sumner Chemical Co., Inc., Zeeland, Michigan, when its new building on its 11-acre site in that area is completed. A contract has recently been let to Elzinga and Volkers of Holland, Michigan, for the new structure. It will be used for proposed new products.

• **Construction is to start** immediately on an expansion of Darco Corp.'s activated carbon plant at Marshall, Tex. Present production capacity will be increased 50% by the end of the year.

• **The Pennzoil Co.** is building a propane-deresining and resin-fractionating unit at its present lube oil plant at Rouseville, Pa. Designed to charge 1,370 barrels of Pennsylvania reduced crude each day, it is scheduled to be completed the latter part of the year. Products will be deresined oil and three resin fractions of exceptionally high viscosity. The M. W. Kellogg Co. was awarded the contract.

Washington

• **Among contracts recently let** by the Department of the Army are the following: To Moxey Savon-Lawric, Inc., New York, N. Y., for 4,466 net long tons of P_2O_5 contained in phosphate rock ($270,594); and to International Ore and Fertilizer Corp., New York, N. Y., for 54,369 net long tons of P_2O_5 contained in phosphate rock ($3,117,432).

• **A project involving construction** of a particle accelerator has been undertaken in the San Francisco Bay area by the U. S. Atomic Energy Commission. Expected to cost about $7 million, the new project involves a classified research program for the AEC.

General

• **Blame for the Texas City disaster** of April 16-17, 1947, in which 560 persons were killed was placed on the United States Government by a Federal District Judge at Houston, Texas. In his opinion, Judge Thomas M. Kennerly, said that charges of negligence were substantially supported by the evidence, and in effect, held the Federal Government liable for the $200 million damage suits filed against the Government as a result of the disaster.

• **The largest international chemical conclave** in history is scheduled for New York in September 1951, when the American Chemical Society celebrates its diamond jubilee. Both the Sixteenth Conference of the International Union of Pure and Applied Chemistry and the Twelfth International Congress of Pure and Applied Chemistry will convene following the seventy-fifth anniversary meeting of the American Chemical Society. Outstanding chemists and chemical engineers from over thirty countries are expected to attend.

• **The National Registry of Rare Crystallographic Data** has been established by Armour Research Foundation of Illinois Institute of Technology. The Registry is a public service of the Foundation, and its information is available to all scientists.

• **U. S. Bureau of Mines claims** that motor fuels can be made from oil shale at 9 cents a gallon were termed "misleading" by A. L. Solliday, executive vice-president of Stanolind Oil and Gas Co. Among objections voiced by

Solliday were the Bureau's leaving out cost of housing workers at remote mining areas and cost of transportation of products from mine to market area; the Bureau's computing its costs on low premium products such as jet, diesel and residual fuels which have little market value or demand; the Bureau's allowing too low a return on capital investment—only 3%—in spite of the great risk involved in such a venture; and the Bureau's putting capital investment at unrealistic low levels.

Ownership Changes

• **Golwynne Chemicals Corp.,** New York, N. Y., has acquired control of Mullite Refractories Co., Shelton, Conn. Mullite is a refractory manufacturer.

• **Pyridium Corp.** has consolidated with Nepera Chemical Co., Inc., and is now known as Nepera Chemical Co., Inc., with headquarters in Nepera Park, Yonkers, N. Y. Properties and contracts of Pyridium Corp. have been vested in Nepera Chemical Co., which has assumed all obligations and will carry out all contracts of Pyridium.

• **Foster D. Snell, Inc.,** New York, has purchased the laboratories of G. C. Supplee Research Corp., Bainbridge, N. Y. This purchase gives the Snell organization an integrated unit for supply of rats, and running of vitamin determinations on animals.

New Companies

• **A Salem, Ore., group,** organized as Continental Chemical Co., has acquired the Government-owned alumina-from-clay plant at Salem on a three-year lease with option to buy. Work is to begin immediately on renovating the plant to produce ammonium sulphate.

Raymond H. Blanchard (left), vice-president of Hood Rubber Co., who has been elected president of Hood; and T. J. O'Dwyer, appointed district manager of the midwest sales area for the chemical division of Celanese Corp. of America.

• **A consulting laboratory** has been opened at 31 South Street, New York, N. Y., by Norman Applezweig, formerly general manager and technical director of Hygrade Laboratories, Inc. The new company will concern itself with research relating to development of new biochemical products and processes.

Foreign Developments

• **Atlas Powder Co., Canada, Ltd.,** is a new company jointly formed by Atlas

• **Chemical companies** report the following sales and earnings on past operations:

Company	Sales for the Year Ending December 1949	Sales for the Year Ending December 1948	Net Income After Taxes Year Ending December 1949	Net Income After Taxes Year Ending December 1948
Air Reduction Co., Inc.	$89,528,737	$94,855,827	$6,198,436	$6,457,947
Canadian Industries Ltd.	102,900,000	90,300,000	9,000,889	7,727,929
Diamond Alkali Co.	48,430,652	51,230,184	3,042,298	5,280,632
Eastman Kodak Co. & U. S. Subsidiaries	396,232,518	414,977,519	49,770,699	51,263,118
General Aniline & Film Corp. & Subsidiaries	80,492,984	91,043,180	2,926,810	8,604,919
Michigan Chemical Corp.	4,960,644	4,142,068	267,683	
Pennsylvania Salt Mfg. Co.	34,501,607	33,860,532	2,686,760	2,284,233

	Sales for Quarter Ending March 31 1950	Sales for Quarter Ending March 31 1949	Net Income After Taxes Quarter Ending March 31 1950	Net Income After Taxes Quarter Ending March 31 1949
Mathieson Chemical Corp.	$17,901,957		$2,202,752	$1,291,552

Powder Co., Wilmington, and G. F. Sterne & Sons, Ltd., Brantford, Canada. The new company, with headquarters at Brantford, will manufacture and distribute Atlas industrial chemicals. W. S. Sterne is president of the new company, and F. E. Sterne is managing director. The Sterne organization has been Atlas' Canadian representative.

John Gamble Kirkwood (left), California Institute of Technology professor, awarded the 1950 Theodore William Richards Medal for his scientific contributions to statistical mechanics; and Joseph Harrison Brennan, chief metallurgist of the Electro Metallurgical Division of Union Carbide and Carbon Corp., 1950 winner of the Jacob F. Schoellkopf Medal for his contributions to metallurgical practices of the iron alloy industry.

• **L. Givaudan & Cie,** Switzerland, parent company of Givaudan-Delawanna, Inc., will soon be manufacturing aromatic chemicals in a factory outside of London in Warlingham, Surrey. The new factory, consisting of a number of buildings that formerly housed research laboratories, will be primarily devoted to aromatic chemicals not yet made in England or not available from their domestic production in qualities and grades demanded in the British line.

Company Notes

• **Chemical Plants Division of Blaw-Knox Co.** has been authorized to build chlorine and caustic soda plants using the Mathieson stationary mercury cell technique.

• **Morton - Withers Chemical Co.,** Greensboro, N. C., has been formed as the successor to Morton Chemical Co. The company specializes in textile auxiliaries, plasticizers, chemical auxiliaries, fat-splitting catalysts, coatings, and custom-made chemicals.

• **W. C. Hardesty Co., Inc.,** has appointed William E. Phillips, Inc., its Chicago representative. Hardesty will continue to carry warehouse stocks in Chicago from which deliveries can be made immediately.

• **The F. J. Stokes Machine Co.,** Philadelphia, has entered the field of vacuum metallizing with complete equipment for metal coating such products as plastics, crystals, glass, etc. Stokes will furnish complete-

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CALENDAR *of* EVENTS

AMERICAN ASSOCIATION OF CANDY TECHNOLOGISTS, second annual meeting, Waldorf Astoria Hotel, June 6.
AMERICAN CHEMICAL SOCIETY, Pacific Northwest regional meeting, Richland, Wash., June 9-10.
AMERICAN ELECTROPLATERS' SOCIETY, 37th Annual Convention and 4th Annual Conference on Electrodeposition (with Electrodepositors' Technical Society of Gt. Britain), Statler Hotel, Boston, Mass., June 12-15.
AMERICAN GAS ASSOCIATION, production and chemical conference, Hotel New Yorker, New York City, May 22-24.
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, regional meeting, Swampscott, Mass., 28-31.
AMERICAN INSTITUTE OF CHEMISTS, Hotel New Yorker, New York City, May 11-12.
AMERICAN SOCIETY FOR QUALITY CONTROL, national convention and Midwest conference, The Milwaukee Auditorium, Milwaukee, Wis., June 1-2.
AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting and exhibit of testing apparatus and equipment, Atlantic City, N. J., June 26-30.
CHEMICAL INSTITUTE OF CANADA, annual conference, Royal York Hotel, Toronto, Canada, June 19-22.
CHEMICAL SPECIALTIES MANUFACTURERS ASSOCIATION, Drake Hotel, Chicago, June 12-13.
COLUMBIA UNIVERSITY, DEPARTMENT OF INDUSTRIAL ENGINEERING, conference on costs, budgeting and economics of industrial research, June 12-16.
INSTITUTE OF FOOD TECHNOLOGISTS, decennial conference, Edgewater Beach Hotel, Chicago, May 21.
INSTRUMENT SOCIETY OF AMERICA, fifth national instrument exhibit, Memorial Auditorium, Buffalo, N. Y., Sept. 18-22, 1950.
LIQUEFIED PETROLEUM GAS ASSOCIATION, Palmer House, Chicago, May 7-13.
MANUFACTURING CHEMISTS ASSOCIATION, annual meeting, Hotel Monmouth, Spring Lake, N. J., June 19-20.
NATIONAL CHEMICAL EXPOSITION, Chicago Coliseum, Chicago, Sept. 5-9.
NEW ENGLAND INDUSTRIAL WASTES CONFERENCE, Massachusetts Institute of Technology, June 26-28.
SOCIETY FOR APPLIED SPECTROSCOPY, fifth annual meeting, Socony Vacuum Training Center, New York City, May 26-27.
SOCIETY OF COSMETIC CHEMISTS, spring meeting, Savoy Plaza Hotel, New York City, May 19.
TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, joint conference of fundamental research committee of technical section with Canadian Pulp and Paper Association, Quebec, May 29-31.

PERSONNEL

Company Officers

• Leavitt N. Bent, vice-president of **Hercules Powder Co.**, was appointed vice-chairman of the board of directors, a newly created post.

• Eric W. Luster has succeeded Nathaniel E. Loomis as vice-president of **Standard Oil Development Co.**, central research organization of Jersey Standard. Dr. Loomis has retired after 32 years of service with Standard Oil Co. (N.J.)

• General Brehon Somervell, president of **Koppers Co., Inc.**, since May, 1946, has been named chairman of the company's board of directors. His election followed the retirement of J. P. Williams, Jr., as company chairman.

• Louis F. Weyand, vice-president in charge of the **Minnesota Mining & Manufacturing Co.'s** adhesives and coatings division, has been elected to the firm's board of directors.

Associations

• Newly elected officers of **The Chemists' Club**, New York, N. Y., for the year 1950-1951 are H. E. Thompson, Union Carbide and Carbon Corp., president; W. F. George, Hooker Electrochemical Corp., vice-president; Walter A. Schmidt, Western Precipitation Co., non-resident vice-president; R. T. Major, Merck & Co., suburban vice-president; L. Van Doren, Watson, Bristol, Johnson & Leavenworth, secretary; and I. Vandewater, R. W. Greeff & Co., treasurer.

• Carleton H. Palmer, chairman of the board of E. R. Squibb & Sons, was elected president of the **American Drug Manufacturers' Association.**

Died

• Franklin H. Stafford, president of the **Verona Chemical Co.**, on April 6.

• Carl M. Black, associated with the Chicago chemical industry for fifty years and for twenty-five years midwestern representative of **S. B. Penick & Co.**, March 11, in California.

• Dr. Herbert M. Kaufmann, chairman of the board of directors of **Mutual Chemical Co. of America**, March 20th, at his home after a short illness. He was in his eighth year.

CHEMICAL MARKETS

U. S. Exports Check Rate of Decline

U. S. chemical exports of $851 million in 1949 were less than 1% under 1948 and only 3½% below 1947's all-time high. This compares with a total export decline of 5% from 1948, 17% from 1947. Principal chemical declines were shown in coal-tar products, industrial chemicals, and soap and toilet goods, while pharmaceuticals and specialties registered a 16% gain. After holding first place among foreign markets for U. S. chemicals for many years, Europe lost that position last year to North America.

Report Shows Distribution Of H_2SO_4 Industry

Information on the geographic distribution of the sulfuric acid industry is contained in the Bureau of the Census Facts for Industry release M19A.1-07, the fourth in a series designed to give such data to producers and consumers of this basic chemical commodity. The statistics show production, shipments, and number of producing plants, by divisions and states, 1947, and differ slightly from figures shown in Facts for Industry release M19A-07, "Inorganic Chemicals, Summary for 1947," and the 1947 Census of Manufactures pamphlet MC28A, "Industrial Inorganic Chemicals," and should be considered revised and final.

The data are based upon reports from all known commercial producers and do not include plants owned by the government and operated in conjunction with ordnance works and arsenals. The following table taken from information in the report, shows production and shipments of sulfuric acid (100% H_2SO_4) by process and by divisions of the country in 1947:

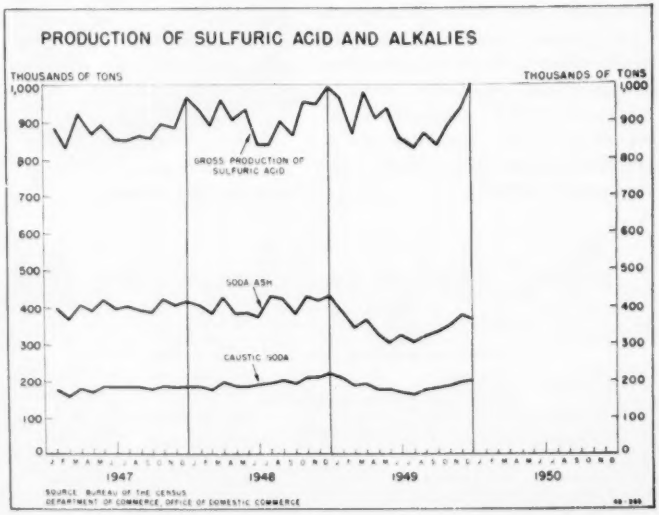
SULFURIC ACID INDUSTRY, 1947

	Shipments (short tons)	*Production (short tons)*
Contact proc., tot.	5,161,795	7,505,413
Oleum under 40%	407,840	628,699
Oleum 40% and over	127,004	245,950
Other than oleum	4,626,951	6,630,764
Chamber proc., tot	1,662,961	3,274,753
H_2SO_4 (gross), tot.	6,824,756	10,780,166
New England	102,156	183,151
Middle Atlantic	1,558,181	2,288,498
Pennsylvania	744,565	855,608
Other	813,616	1,432,890
North Central	1,584,241	2,418,801
Illinois	1,013,123	1,348,909
Indiana		
Michigan	102,928	133,244
Ohio	446,755	624,377
Other	21,435	312,271
South	2,862,891	5,062,336
Alabama	60,996	184,333
Georgia	36,525	241,789
Louisiana	343,666	462,049
South Carolina	12,200	165,981
Other	2,409,504	4,008,184
West	717,287	827,380

Chemical Manganese Added To Stockpile Purchases

Chemical grade manganese has been added by the Munitions Board to the list of materials to be purchased for the stockpile. In addition, the Munitions Board has revised the stockpile objectives for chromite (chemical grade), coconut oil, palm oil, tin, castor oil and celestite.

The new addition to the list, chemical grade manganese, is used primarily to produce hydroquinone, which is used in the production of synthetic



Bulk shipping keeps pace with chemical progress

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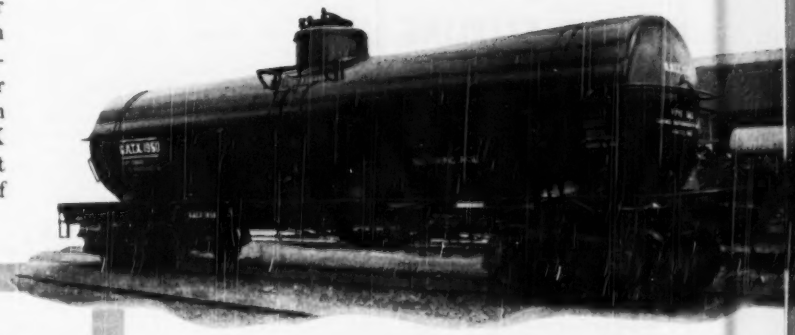
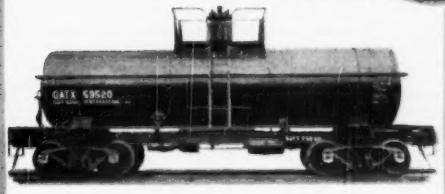
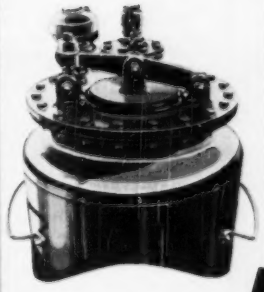
General American now makes it possible to ship up to 11,800 gallons of sulphuric acid in a single tank car. These cars are a result of the GATX program of continuous research and development for the chemical industries, through which GATX makes similar shipping economies possible for your other commodities also. More than 200 types of specialized GATX tank cars supply safe, low-cost transportation for shipments of bulk liquids.



This modern 11,800-gallon GATX sulphuric acid car is one of the largest now in service.



Shipments of smaller quantities of sulphuric acid are made economically in 7000-gallon GATX cars.



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Bulk shipping keeps pace with chemical progress

rubber and in photographic chemicals. The production of nicotinic acid, potassium permanganate, plastic stabilizers and dye intermediates, also requires the use of this ore.

ECA Chemicals Reach $212 Million

Chemicals and related products procurement authorizations since the beginning of the European Recovery Program, April 3, 1948, to the end of 1949 reached nearly $212 million with paid shipments amounting to 65%, according to the U. S. Department of Commerce. Although procurement authorizations for chemicals were less than 3 per cent of the total $8,000 million procurement authorizations, they represented a sizable portion of the total exports of chemicals to Europe.

Medicinals and pharmaceutical preparations accounted for approximately 20 percent of the authorizations, with industrial chemicals amounting to 14 percent, alcohol 7 percent and pesticides 1 percent. Other and unclassified chemicals composed the remaining 58 percent.

About 93 percent of the procurement authorizations for chemicals and related products was for commodities to be obtained in the United States.

Market Review

Coaltar chemicals continued to be the center of interest in the chemical market scene. Not only did basic materials remain in the tight category, but some of the more important price changes of the month took place with reductions in phthalic anhydride and naphthalene.

Benzol, toluol, and xylol continued very tight, and there seemed to be no possibility of much change in the steady heavy demand for these materials. Phenol, dependent upon benzol, was still scarce, and booming styrene kept up the pressure on benzol. A happy note, however, was that most consumers seemed to be able to get enough benzol to take care of their most urgent requirements.

Phthalic anhydride was lowered 4¢ a pound to establish the tankcar price at 17½¢, and a full 1¢ a pound reduction followed for naphthalene. Crude went to 4¾¢ for 78° material and 4¼¢ for the 74° type, while refined industrial was listed at 8¢, all prices for tankcars. New price for flakes or balls in barrels, carlot quantities, is 11¢ a pound. Heavy imports of crude naphthalene combined with a dip in demand for phthalic production caused the reduction.

Phthalate plasticizers followed the downward phthalic trend with price cuts ranging from 1½¢ to 3¢ a pound. Tankcar prices of dioctyl phthalate, off 2¢, is 38¢ a pound; dibutyl phthalate, off 1½¢, 27½¢; diethyl phthalate, off 2½¢, 22¢; and dimetyl phthalate, off 3¢, 22¢.

Pesticide materials were also in the very tight category, with supplies of benzene hexachloride sold out ahead through the summer season, and DDT in a somewhat similar situation. Other insecticides such as pyrethrum and methoxychlor reflected the strong call for these materials, and stocks were scarce.

In the heavy chemicals group, chlorine showed little change in supply position. It was still short, and strong demand for copper sulfate and sodium chlorate put them in a similar position, for the time being at least. Among price changes were a ¼¢-a-pound advance in sodium silicofluoride, establishing a carlot price of 4½¢; reductions of ¼¢ to 1½¢ a pound in leaded metallic soaps; and reductions in tin derivatives. The new prices: lead naphthionate, 24%, 19¾¢; lead linoleate, precipitate and fused, 32¢ and 30¢ resp.; lead resinate, 16% and 19%, 18¼¢ and 19¾¢ resp.; lead tallate, 16% and 24%, 12½¢ and 16¾¢ resp.; tin crystals, 58¢; and sodium stannate, 43.8¢.

Reductions characterized price developments in fine chemicals as Chilean crude iodine was reduced from $1.729 to $1.52, the price for domestic iodine, and silver salts were cut in keeping with the downward trend of silver bullion. Silver nitrate was priced at 45⅞¢ an oz.; silver cyanide, 65⅛¢; and silver chloride, 66¾¢, all prices for 2,500 oz. quantities. A 50¢ reduction in sulfathiazole established the price at $3 a pound in 1,000 pound quantities. Increased production of synthetic vitamin A resulted in a price slash of 6¢ per million units that set current quotations at 24¢ per million units. Both crude and refined glycerine moved in good volume as demand improved.

Among paint materials, the shellac market was weak with lower prices in the face of little demand. Bleached shellac, for example, went from 56½¢ to 52½¢ in lots of 1,500 pounds or more. A ¼¢ reduction in white lead, dry basic sulfate, making the price 12¼¢ a pound, reflected an earlier decline in pig lead. Zinc oxide prices went up ⅛ to ½¢ a pound, establishing prices of 11½¢ for the American process material; 11½¢, for the leaded 5%; 11¾¢ for leaded 35%; 11⅞¢ for leaded 50%; 13¾¢ for French process lead free; and 14¾¢ for USP.

Carnauba wax obtained through barter deals in the primary center in Brazil were being offered at as much as 20¢ a pound below the floor price established there. Since it was difficult to learn how much carnauba was involved, the domestic market was shaken, with prices on No. 1 yellow going to 89¢ a pound, while the minimum export price is $1.09 f.o.b. Brazil. No. 2 yellow was 87¢; No. 2 NC, 75¢; No. 3 NC, 69¢; and refined, 74¢ a pound. Refined ouricury was also weaker.

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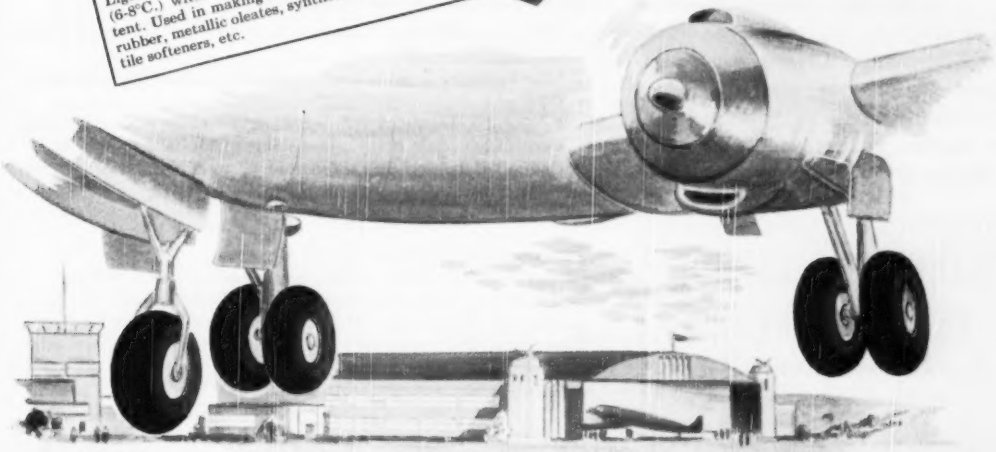

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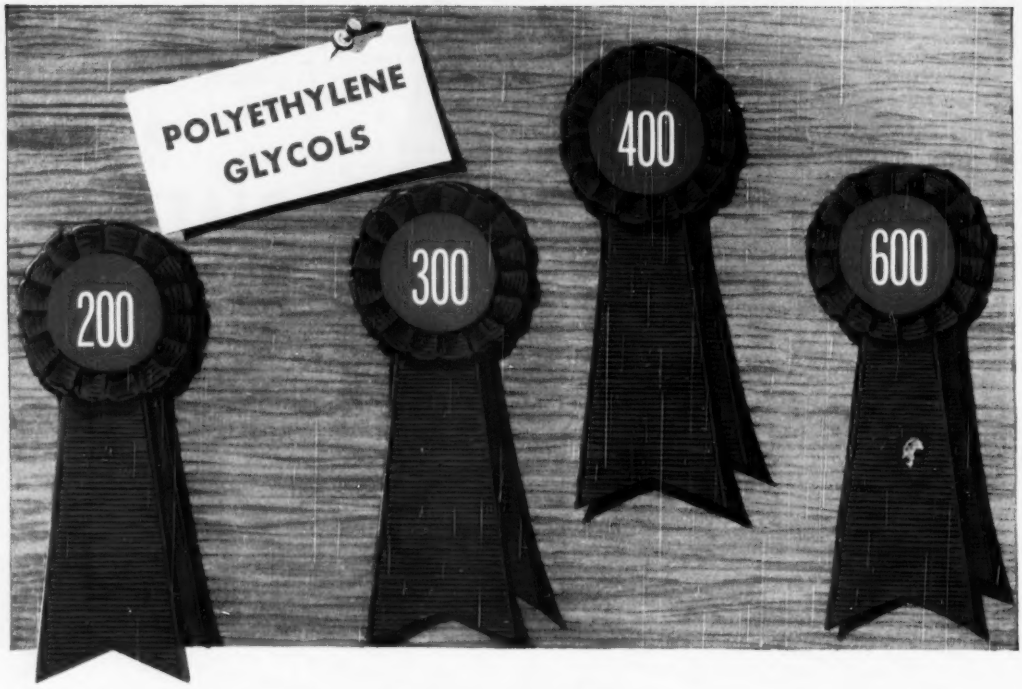

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Furfural	1	Amber Liquid	—36.5	161.7
Furfuryl alcohol	1	Amber Liquid	—31.0	171 (750 mm.)
Furoic acid	1	White Crystals	131-132	
Hydrofuramide	1	Light Brown Crystals	117	250 (dec)
5-Nitrofurfural diacetate (Pharmaceutical quantities)	6	Yellow Crystals	91.5	
5-Nitrofurfural semicarbazone (Pharmaceutical quantities)	6	Yellow Crystals	227 (dec)	
Tetrahydrofuran	4	Colorless Liquid	—108	65.4
Tetrahydrofurfuryl alcohol	1	Colorless Liquid	below —80	170-180
Tetrahydrofurfuryl oleate	2, 7	Colorless Liquid		240 (5 mm.)

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Compound	Source*
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Ethyl furoate	6, 9
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Furfural acetone	5, 9
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Furfural dibutyrate	6
Furfural dipropionate	6
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Furfural semicarbazone	6
5-Furfural-2-thiohydantoin	5
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Furfuryl methyl ether	6
Furfuryl propionate	6
Furil	5, 8
α-Furil dioxime	5, 8
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Furoin	5, 8
Furoyl chloride	5
Furylacrolein	5
Furylacrylamide	5
Furylacrylic acid	5, 10
n-Hexyl furoate	9
Methylfuran	4
Methyl furoate	6, 9
Methyl 5-nitro furoate	6
Methyltetrahydrofuran	4
5-Nitrofurfural	6
5-Nitrofurfural dibutyrate	6
5-Nitrofurfural dipropionate	6
5-Nitrofurfuryl acetate	6
5-Nitrofurfuryl alcohol	6
5-Nitrofurfuryl propionate	6
5-Nitrofuroic acid	6
n-Propyl furoate	9
N-2-Pyridyl furfuryl amine	6
Tetrahydrofurfuryl acetate	5
Tetrahydrofurfuryl adipate	5
Tetrahydrofurfuryl benzoate	5
Tetrahydrofurfuryl palmitate	2, 5
Tetrahydrofurfuryl propionate	5, 9

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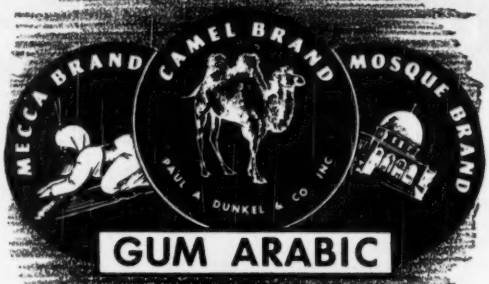

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GUM TRAGACANTH

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Electrodeposition of gold on tantalum from an electroplating bath solution consisting of gold chloride, sodium cyanide and water, rinsing and heating. 2,492,204. U. S. A. as represented by the Secretary of War.

In smelting zinc in which an agglomerated charge of mixed zinciferous material and carbonaceous reducing agent is passed downwardly through an externally heated vertical retort, the improvement which comprises admitting an oxygen-bearing gas into the upper portion of the vertical retort and withdrawing zinc vapor-bearing gases from the lower portion of the retort to maintain a flow of the gases and vapor concurrently with the charge downwardly through the retort, and condensing the withdrawn zinc vapors in a splash-type condenser. 2,492,438. New Jersey Zinc Co.

Carburizing steel articles by immersing in a molten salt bath consisting of alkali metal chloride, together with finely divided carbon, an oxygen compound more acidic than alkali metal carbonate selected from the group consisting of the oxygen-containing compounds of boron and silicon and an alkali metal carbonate. 2,492,803. E. I. du Pont de Nemours & Co.

Case hardening process by treating steel articles in a molten salt bath consisting of alkali metal cyanide, an oxygen-containing boron compound more acidic than alkali metal carbonates, alkali metal carbonate, finely divided carbon dispersed in the bath and alkali metal halide. 2,492,804. E. I. du Pont de Nemours & Co.

Case hardening bath replenishing composition consisting of sodium cyanide, sodium chloride, sodium carbonate, and carbon. 2,492,805. E. I. du Pont de Nemours & Co.

Froth flotation process which comprises subjecting an aqueous pulp containing a mineral included in the group consisting of molybdenum sulfide, carbon, strongly hydrophobic hydrous aluminum-containing silicates and strongly hydrophobic hydrous magnesium silicates and at least one sulfide mineral, to froth flotation in the presence of an inorganic compound of an element selected from the group consisting of phosphorus, arsenic and antimony. 2,492,936. C. M. Nokes, C. G. Quigley and R. T. Pring.

Depositing dense and adherent copper by passing electric current through a bath of bivalent copper, pyrophosphate, (P_2O_7), nitrate (NO_3) and ammonia (NH_3). 2,493,092. United Chromium, Inc.

Recovering silver from a dilute solution of a silver compound by contacting said solution with a solid insoluble lignin and recovering the silver from the lignin. 2,493,396. Timber Engineering Co.

Solution for the electrolytic polishing of steel and iron articles consisting of phosphoric acid, water, a member of the class consisting of tri-alkali metal phosphate, di-alkali metal phosphate, mono-alkali metal phosphate, and phosphorus pentoxide, and a sulphate of the class consisting of alkali metal sulphate and ammonium sulphate. 2,493,579. Standard Steel Spring Co.

Zinc smelting. 2,493,823. National Zinc Co., Inc.

Flotation of titanium oxide mineral concentrates in the presence of a promoter selected from the group consisting of the higher aliphatic fatty acids, talloel, resin acids, naphthenic acids mixtures of these materials, and their sodium, potassium and ammonium soaps whereby a bulk concentrate is obtained; subjecting an aqueous pulp of the bulk concentrate to agitation in the presence of soluble alkali metal silicate and an alkali selected from the group consisting of sodium, potassium and ammonium hydroxide; subjecting the conditioned bulk concentrate to froth flotation in the presence of a promoter. 2,494,139. American Cyanamid Co.

Electrodepositing nickel directly on zinc-base metal from a bath containing tartrate ions, nickel ions and chloride ions, ammonium ions, and water. 2,494,205. International Nickel Co., Inc.

Making gray cast iron by introducing into a molten mass a small percentage of copper fluoride. 2,494,238. Waterbury Farrel Foundry & Machine Co.

Producing a hardened surface on ferrous metal by contacting with gaseous diborane whereby metal boride is formed. 2,494,267. U. S. A. as represented by the U. S. Atomic Energy Commission.

Organic

Upgrading rosin by treating metal-free rosin with free selenium in the presence of added acid which is stronger than rosin acids to decrease the degree of unsaturation without aromatization of more than one ring of the nucleus. 2,492,145. Glidden Co.

Refining polymerized rosin by heating a polymerized rosin with free selenium for a time of 30 minutes but insufficient to cause substantial decarboxylation. 2,492,146. Glidden Co.

3-hydroxy-11-keto-20-amino pregnane. 2,492,188. Merck & Co., Inc.

3,17-dihydroxy-11-ketapregnenes-20. 2,492,189. Merck & Co., Inc.

Δ^{20}, 21-3,17-dioxy-11-ketopregnenes. 2,492,190. Merck & Co., Inc.

21-bromopregnenes. 2,492,191. Merck & Co., Inc.

Δ^{17}, 20-3,21-dioxy-11-ketopregnenes. 2,492,192. Merck & Co., Inc.

Δ^{17}, 20-3,11-diketo-21-hemisuccinoxypregnene. 2,492,193. Merck & Co., Inc.

3,11-diketo-17 (β) -20,21-trihydroxypregnane. 2,492,194. Merck & Co., Inc.

3,11-diketo-4-bromo-17 (β) -hydroxy-20,21-diacetoxypregnane. 2,492,195. Merck & Co., Inc.

Preparation of alpha-glycols, which comprises reacting mono-unsaturated compounds with a reagent of the group consisting of performic acid and mixtures containing hydrogen peroxide and formic acid, and hydrolizing the resulting ester. 2,492,201. U. S. A. as represented by the Secretary of Agriculture.

Methacrylic ester of a carbohydrate of the group consisting of starch, dextrin, maltose, and glucose. 2,492,203. U. S. A. as represented by the Secretary of Agriculture.

Forming metal salts of substituted dithiocarbamic acids by contacting a compound chosen from the class consisting of metal oxides and hydroxides while preponderantly in an undissolved condition with carbon disulfide and a compound chosen from the class consisting of primary and secondary aliphatic, heterocyclic, and cycloaliphatic amines. 2,492,314. Sharples Chemicals, Inc.

Imidazolone. 2,492,373. John L. Wood and Vincent du Vigneaud (to the People of the U. S.).

Production of butyric anhydride, by heating crotonic anhydride in the liquid phase with hydrogen under pressure in the presence of Raney nickel. 2,492,403. Celanese Corp. of America.

Producing methylol derivatives of pyrrole from pyrrole and a formaldehyde substance taken from the group consisting of anhydrous formaldehyde gas, paraformaldehyde and alpha-polyoxymethylene in the presence of a catalyst taken from the group consisting of alkali metal hydroxides, alkali metal carbonates, tri alkali metal phosphates, and benzyl trimethyl ammonium hydroxide. 2,492,414. E. I. du Pont de Nemours & Co.

Photochemical chlorination of esters of fatty acids having a carbon chain of at least 12 carbon atoms, fatty acids having a carbon chain of at least 12 carbon atoms and petroleum hydrocarbons having a carbon chain of at least 15 carbon atoms, by dispersing the material in a solvent selected from the class consisting of acetic acid, monochloroacetic acid, di-chloroacetic acid, tri-chloroacetic acid and propionic acid, and dispersing chlorine gas through the solution while exposed to visible light. 2,492,417. Pierce Laboratory, Inc.

Anthraquinone-acridones. 2,492,802. American Cyanamid Co.

Hydroxycyanothiophane carboxylic acids and esters. 2,492,827. American Cyanamid Co.

Tetrahydrothieno uracils. 2,492,828. American Cyanamid Co.

Sulfolanyl ether of an alpha, gamma-dimethyl-alpha, gamma-dihydroxybutane. 2,492,927. Shell Development Co.

N-substituted carbamate in which the N-substituent is—CH_2R where R is the hydrocarbon radical of a stabilized rosin acid and is attached to the CH_2 group through the 1-position. 2,492,938. Hercules Powder Co.

Complex metal amine salt of a stabilized rosin amine and a complexogen metal salt prepared by reacting a stabilized rosin amine with a complexogen metal salt of the group consisting of the acetate, nitrate, chloride, bromide, iodide, fluoride, propionate, stearate, and sulfate of the metals copper, zinc, chromium, mercury, silver, aluminum, manganese, iron, cobalt, nickel, calcium, and cadmium. 2,492,939. Hercules Powder Co.

Chlorination by substitution of chlorpropane, by means of gaseous chlorine, which comprises contacting the liquid organic material with a material of the group consisting of the alkali metal and alkaline earth hydroxides and alkali metal carbonates; removing the alkaline material and any suspended solids from the organic material; and passing gaseous chlorine into the organic material under actinic light. 2,492,941. Hooker Electro Chemical Co.

Preparation of unsaturated hydrocarbons from unsaturated ketones. 2,492,956. Shell Development Co.

Reacting sulfur trioxide and methane to form reaction products comprising a methyl ester of sulfuric acid and at least one compound selected from the group consisting of sulfonic acids of methane and methyl esters thereof, hydrolyzing said methyl ester to obtain methanol, processing said reaction products so as to obtain methane sulfonic acid therefrom, and thermally decomposing said methane sulfonic acid to form sulfur dioxide and methanol. 2,492,983. Houdry Process Corp.

Subjecting a metallic polyhalide and one compound selected from the group consisting of methanol and dimethyl ether to conversion conditions and forming substantial amounts of recoverable hydrocarbons having at least 4 carbon atoms. 2,492,984. Houdry Process Corp.

In oxidation of a volatile low molecular weight aliphatic hydrocarbon to form oxygenated organic compounds, the improvement which comprises reacting said hydrocarbon with molecular oxygen under conditions adapted to maintain said hydrocarbon substantially completely in the vapor phase at superatmospheric pressures in the presence of a catalytic liquid in the form of a thin film. 2,492,985. Houdry Process Corp.

Product adapted for use in a process for directly producing carbon dioxide from hydrogen and carbon containing compounds, consisting of cupric oxide, a material selected from the group consisting of aluminum oxide, magnesium oxide, silicon oxide and zirconium oxide, and a material selected from the group consisting of ferric oxide, cobalto cobaltic oxide, manganic oxide and nickel oxide. 2,492,986. Kidde Mfg. Co., Inc.

Bituminous compositions. 2,492,994. Shell Development Co.

Fluorination of unsaturated halocarbons with cerium tetrafluoride. 2,493,007. Purdue Research Foundation.

Fluorination of saturated halocarbons with cerium tetrafluoride. 2,493,008. Purdue Research Foundation.

Heating hexachlorocyclopentadiene and concentrated sulfuric acid to form 2,3,4,4,5-pentachloro-2-cyclopentenone. 2,493,009. Purdue Research Foundation.

Forming at least one compound selected from the group consisting of methane sulfonic acid, methionic acid, methyl esters of sulfuric acids, methanol and methyl esters of sulfonic acids of methane by reacting methane and sulfur trioxide in the presence of a catalyst selected from the group consisting of metals and sulfates of metals in group II-B of the periodic table. 2,493,038. Houdry Process Corp.

N,N'-diacyl-tetrahydro-1,3,5-oxadiazines. 2,493,068. E. I. du Pont de Nemours & Co.

Reacting carbon disulfide with a dry alkali-metal derivative of a reactive methylene compound, O-CH_2-COOR, where O is selected from the group consisting of -COOR, -COR_R and -CN, and R_1, R_2, and R_3 are hydrocarbon groups, and reacting the resulting reaction product with an

alkylating agent taken from the group consisting of alkyl halides, dialkyl sulfates, alkyl-p-toluene sulfonates, alkylene dihalides, benzyl halides, benzyl sulfates and chloracetic acid alkyl esters. 2,493,071. Ilford Ltd.

2,3-alkyl substituted glycidamides where the alkyl substituents contain 1 to 3 carbon atoms. 2,493,090. Wm. S. Merrell Co.

In manufacture of 2,4-dichlorophenoxy compounds, the step of chlorinating molten phenol and reacting said product with an alpha-haloalkylcarboxylic acid in the presence of a base. 2,493,126. Imperial Chemical Industries Ltd.

Production of a 2,7-disubstituted acridone by heating a 3':4-disubstituted diphenylamine-2-carboxylic acid. 2,493,191. Ward, Blenkinsop & Co. Ltd.

Imidazolium compounds. 2,493,318. Eli Lilly & Co.

Substituted imidazolium compounds. 2,493,319. Eli Lilly & Co.

Substituted dihydroimidazolium compounds. 2,493,320. Eli Lilly & Co.

Dihydroimidazolium compounds. 2,493,321. Eli Lilly & Co.

Imidazolinium compounds. 2,493,322. Eli Lilly & Co.

Angelica lactone dimer. 2,493,373. A. E. Staley Mfg. Co.

Hydrogenated angelica lactone dimer. 2,493,374. A. E. Staley Mfg. Co.

Lactone acid of angelica lactone dimer. 2,493,375. A. E. Staley Mfg. Co.

Preparing iodinated 2-amino-thiazole by reacting iodine chloride with a 2-amino-thiazole in the presence of an acid. 2,493,399. Societe Generale d'Applications Terapeutiques "Theraplix."

Composition of matter comprising benzyl chloride containing impurities and a stabilizing amount of di-2-ethylhexylamine. 2,493,427. Food Machinery and Chemical Corp.

Stabilizing a sulphated product formed by reacting sulphamic acid with an organic compound consisting of C, H and O atoms and containing at least one functional group selected from the class consisting of ethers, carboxylic acid esters and alcohols, said organic compound containing at least one alcoholic-OH group capable of sulphation, which comprises heating with a reagent capable of destroying the residual sulphamic acid. 2,493,444. Colgate-Palmolive-Peet Co.

Stabilizing a sulphated product formed by reacting sulphamic acid with an organic compound consisting of C, H and O atoms which comprises treating said sulphated product with nitrous acid. 2,493,445. Colgate-Palmolive-Peet Co.

Ketotetrahydropyridine derivatives. 2,493,520. Hoffmann-La Roche, Inc.

Stabilizing commercial xylidine against discoloration during storage by reacting carbon disulfide with a small portion thereof to form tetramethyl thiocarbanilide derivatives. 2,493,544. Standard Oil Development Co.

Basic lead salts of 2:4 dinitro resorcinol. 2,493,549. Imperial Chemical Industries, Ltd.

Basic lead salts of 2:4 dinitro resorcinol. 2,493,550. Imperial Chemical Industries, Ltd.

Production of normal lead dinitroresorcinate. 2,493,551. Imperial Chemical Industries, Ltd.

Preparation of a pure hydrocarbon from a feedstock consisting of n-hexane, benzene, methylcyclopentane, cyclohexane and 2,2- and 2,4-dimethylpentanes, by distillation to remove a primary fraction which is distilled in a second distillation zone in the presence of sufficient azeotrope-forming hydrocarbon, such as benzene, to ensure the recovery of pure cyclohexane as a residual fraction, an overhead fraction comprising any cyclohexane not retained in the residue fraction, together with azeotropic mixtures comprising methylcyclopentane and dimethylpentanes with benzene and any other azeotrope-forming hydrocarbon present, the overhead fraction then being treated for the recovery of substantially the whole of the benzene in the overhead fraction and the production of a benzene-freed fraction, the said benzene-freed fraction being then passed to an isomerisation zone in which a substantial part of its methylcyclopentane content is converted into cyclohexane, and a substantial part of the 2,2-dimethylpentane and 2,4-dimethylpentane converted to hydrocarbons of different boiling point. 2,493,567. Anglo-Iranian Oil Co., Ltd.

Synthetizing dibenzylidene anhydroenneaheptitol by reacting benzaldehyde with a compound selected from the group comprising anhydroenneaheptitol and diisopropylidene anhydroenneaheptitol in concentrated hydrochloric acid. 2,493,572. Cities Service Oil Co.

Cyanolkyamino derivatives of acridine. 2,493,578. Ward, Blenkinsop & Co., Ltd., and Howards & Sons, Ltd.

Beta-chloroethyl-p-trichloromethyl benzoate. 2,493,615. E. I. du Pont de Nemours & Co.

P-aminomethyl-benzene-sulfonamide salt of a member of the group consisting of sulfathiazole, N'-benzoyl-sulfanilamide, sulfadiazine, 2-(p-aminobenzene-sulfanamido)-as-thiazoline, sulfamerazine, sulfamethazine, and sulfapyrazine. 2,493,632. E. R. Squibb & Sons.

Preparing oleonitrile by reacting ammonia and oleic acid in the presence of a cobalt salt of a carboxylic acid having 10 to 22 carbon atoms. 2,493,637. Rohm & Haas Co.

Nicotinic acid-β-picolyl-amide. 2,493,645. Hoffmann-La Roche Inc.

Cobalt bis-(3-fluorosalicylaldehyde)-ethylenedimine. 2,493,654. Regents of the University of California.

Pseudo cyclohexyl ester of levulinic acid. 2,493,676. A. E. Staley Mfg. Co.

Azo guanamines. 2,493,703. American Cyanamid Co.

Dimethyl carbamic acid esters of phenolic primary alkylamines and phenolic secondary alkylamines, and the salts thereof. 2,493,710. Hoffmann-La Roche Inc.

Di-aryloxy-methanes. 2,493,711. Dow Chemical Co.

Preparing a 1-alkyl-2-(p-hydroxyphenyl)-3-alkyl-6-hydroxy-indane by reacting a 2-(p-alkoxyphenyl)-3-alkyl-6-alkoxy-indene with an aldehyde, hydrogenating the fulvene obtained and converting the alkoxy groups of the resulting indane to hydroxyls by dealkylation. 2,493,729. Hoffmann-La Roche Inc.

2-(p-oxyphenyl)-3-isopropyl-6-oxy-indanes. 2,493,730. Hoffmann-La Roche Inc.

Isolating 2,2,6,6-tetramethylolcyclohexanol from an aqueous reaction mixture resulting from the condensation of cyclohexanone and formaldehyde in the presence of a calcium oxide catalyst. 2,493,733. General Mills, Inc.

Hydrophenanthrene carboxylic acids. 2,493,773. Ciba Pharmaceutical Products, Inc.

3,11-diketo-17,20-dihydroxy-pregnanes. 2,493,780. Merck & Co., Inc.

Isolating and purifying a crystalline alkylated phenol from an acidic crude mixture of the alkylated phenol by washing with hot water, agitating with an aqueous alcohol solution in which the alkylated phenol has slight solubility to form two liquid phases, cooling a resulting mass of said aqueous alcohol solution mixed with said washed crude mixture until the mass becomes a slush containing crystals of the alkylated phenol, separating and thereafter washing and drying the separated crystals. 2,493,781. Standard Oil Development Co.

2,4-dinitro-3-ethyl-6-tertiary butyl anisole. 2,493,797. Givaudan Corp.

Recovering abietic acid from mixed resin acid material of the group consisting of rosin, isomerized rosin, tall oil resin acids, and their mixtures, and alkali metal soaps of said materials by preparing an aqueous dispersion containing said resin acid and crystallizing abietic acid therefrom. 2,493,866. Continental Research Corp.

Recovering abietic acid from mixed resin acid material by preparing an aqueous dispersion in partially neutralized condition in water, and crystallizing abietic acid therefrom in the form of its quarter salt. 2,493,867. Continental Research Corp.

Preparation of alkylol-substituted hydroxytetrahydropyrans, their cyclic formals and 4-vinyl-1,3-dioxane by reacting formaldehyde and butadiene in the presence of a polymerization inhibitor and an acidic condensation catalyst. 2,493,964. E. I. du Pont de Nemours & Co.

Heavy metal salts of alkyl phenol sulfides. 2,493,986. Standard Oil Development Co.

Aluminum salts of alkylated phenol sulfides. 2,493,987. Standard Oil Development Co.

Production of unsaturated halides by mixing a symmetrical bis(2-alkenyl) ether containing an even number of carbon atoms not less than 6 nor greater than 8 with an excess of a hydrogen halide, reacting said ether in liquid phase with said hydrogen halide under anhydrous conditions in the presence of a cuprous halide and recovering a 2-alkenyl halide. 2,494,034. Shell Development Co.

Producing fumaric acid by reacting maleic acid with free hydrohalogen acid in the presence of a halide selected from the class consisting of alkali metal chlorides, alkali metal bromides, ammonium chloride and ammonium bromide. 2,494,049. Chemical Concentrates Corp.

4,4'-di-(sec-alkylamino) diphenylamine selected from the group consisting of 4,4'-diisopropylaminodiphenylamine and 4,4'-di-(sec-butylamino) diphenylamine. 2,494,059. Eastman Kodak Co.

Selectively removing formaldehyde from a formaldehyde-glyoxal mixture by adjusting the pH, adding β-naphthol, heating until the formaldehyde reacts with the β-naphthol and separating the reaction product. 2,494,060. General Aniline & Film Corp.

Making a fluorocarbon monohydride by passing a gaseous mixture of hydrogen and a polycarbon fluorocarbon, C_nF_{2n+2}, through a heated tube to effect hydrogenolysis and produce a reaction product having the formula $C_nF_{2n+1}H$. 2,494,064. Minnesota Mining & Mfg. Co.

6-methoxy-8-alpha-ethyl-n-amyl-amino-acetamidoquinoline. 2,494,083. Wyeth Inc.

Barbituric acid derivatives. 2,494,084. Wyeth Inc.

Stabilizing fatty materials against reversion and rancidity produced by oxidation by adding nor dihydro guaiaretic acid with a small amount of citric acid and lecithin. 2,494,114. Swift & Co.

Producing acrylonitrile by feeding ethylene cyanohydrin in liquid phase to a dehydrating zone containing sodium formate as dehydration catalyst and an anti-foaming compound chosen from the group consisting of the monoalkyl and dialkyl ethers of the polyethylene and polypropylene glycols. 2,494,116. American Cyanamid Co.

5-acylamino uracils. 2,494,125. Burroughs Wellcome & Co. (U. S. A.) Inc.

Organic phosphate esters. 2,494,126. American Cyanamid Co.

Neutralizing and completely removing salts before distilling crude high-boiling esters. 2,494,133. American Cyanamid Co.

Reacting cyanogen with a 1,3-diene for preparation of 2-cyanopyridines. 2,494,204. Canadian Industries Ltd.

Hydroprenanthrene compounds. 2,494,253. Ciba Pharmaceutical Products.

Substituted hydrofluorene carboxylic acids. 2,494,254. Ciba Pharmaceutical Products, Inc.

In recovering xylenes from xylene-rich light hydrocarbon fractions by continuous extractive distillation utilizing nitrobenzene as a selective solvent, the improvement which consists of controlling polymer build-up by withdrawing recirculating solvent from the system, diluting it with non-aromatic raffinate, removing precipitated solids, and returning the liquid mixture to the system. 2,494,274. Sinclair Refining Co.

Carbamylalkyl phosphates. 2,494,283. American Cyanamid Co.

Cyanoalkyl phosphates. 2,494,284. American Cyanamid Co.

Producing higher molecular weight purified alkyl phosphates from crude reaction masses and containing acidic impurities which comprises adding an alkali to neutralize said acid and heating whereby said alkyl phosphate is distilled in a pure form. 2,494,310. Food Machinery & Chemical Corp.

Recovery of furfural from furfural-polymer mixtures. 2,494,325. Texas Co.

Composition consisting of aluminum stearate, an alkyl ester of phosphoric acid, and a liquid solvent for aluminum stearate selected from the group consisting of terpenes, aromatic hydrocarbons, aliphatic hydrocarbons, and chlorinated hydrocarbons. 2,494,331. Nopco Chemical Co.

Producing normal heptane from a naphtha containing normal heptane in admixture with hydrocarbons having similar boiling points including methylcyclohexane. 2,494,335. Standard Oil Development Co.

In synthesizing α-hydroxy-β,β-dimethyl-γ-butyrolactone, extracting the same from the aqueous reaction mass by dissolving said lactone in methylene chloride. 2,494,338. Nopco Chemical Co.

Treating hydrocarbons contaminated with organic acids, esters, ketones, alcohols, and aldehydes by admixing the contaminated hydrocarbon with a solution of an alkali metal hydroxide in anhydrous methyl alcohol to cause saponification of said contaminating compounds, settling to separate a hydrocarbon phase, and contacting said phase with an alcoholic solvent to recover hydrocarbons substantially free of said contaminating compounds. 2,494,371. Standard Oil Development Co.

Dialkylamino alkyl piperate and its hydrochloride. 2,494,458. Boyce Thompson Institute for Plant Research, Inc.

Substituted ethers of cyclic sulfones. 2,494,515. Shell Development Co.

2-(benzene sulfonamido)-tetrahydrobenzothiazoles. 2,494,524. Sharp & Dohme, Inc.

Improved rosin characterized by imparting an increased resistance to yellowing in soaps by heating a rosin material under non-oxidizing conditions of selenium derived from at least one catalytic material selected from the group consisting of selenium, selenium oxide and selenium halides, in the presence of an alkali metal required to neutralize the rosin material. 2,494,550. Glidden Co.

Simultaneously changing the composition of coke oven gas and producer gas comprising: feeding coke oven gas as a stream along one side of a porous boundary, passing producer gas in mixture with steam to sweep across the other side of the boundary, to secure a diffusion of hydrogen from the coke oven side to the producer side and to cause a flow of nitrogen, steam and carbon monoxide from the producer gas to the coke oven gas side. 2,494,554. Koppers Co., Inc.

In synthesis of ammonia from hydrogen and nitrogen and synthesis of hydrocarbons from hydrogen and carbon monoxide, the steps comprising converting nitrogen and hydrogen to ammonia in the presence of an iron catalyst with consequent reduction in activity of the catalyst for the ammonia synthesis reaction, subsequently converting carbon monoxide and hydrogen to hydrocarbons in the presence of said catalyst of reduced activity. 2,494,561. Texas Co.

Bis(4-aminocyclohexyl) methane. 2,494,563. E. I. du Pont de Nemours & Co.

Pyrolysis of C-acetoxy aliphatic amides to acrylamides. 2,494,583. U. S. A. as represented by the Secretary of Agriculture.

Condensation of a mercaptan with ethylene oxide in the presence of a catalyst. 2,494,610. Sharples Chemicals Inc.

N-(hydroxy-aryl) aspartic acid diesters. 2,494,650. Allied Chemical & Dye Corp.

Separating progesterone from mixtures of ketosteroids, by condensing progesterone with lutidine-2,6-dicarbonic-3,5-dihydrazide, separating the insoluble hydrazone and regenerating progesterone by decompcsition by means of benzaldehyde. 2,494,678. Les Laboratoires Francais de Chimiotherapie.

Oxidizing mercaptans to disulfides by contacting with oxygen in the presence of an alkali solution and a small amount of a C-nitroso compound selected from the group consisting of aromatic amines and phenols. 2,494,687. Pure Oil Co.

Brominating trifluoromethyl derivatives of benzene by reacting a trifluoromethyl derivative of benzene with bromine. 2,494,817. Corning Glass Works.

Synthesizing a 5,6-dimethoxy-8-nitroquinoline by ring closure on 4-acetamino-5-nitroveratrole by sulphuric acid, the steps which comprise adding the sulphuric acid to a hot mixture of 4-acetamino-5-nitroveratrole, glycerine, and arsenic acid and abruptly terminating the reaction prior to substantial cleavage of the methoxyl substituent para to the nitro-group. 2,494,851. U. S. A. as represented by the Secretary of War.

Preparing methacrolein oxime by decomposing a 2-N-dialkylaminoisobutyraldoxime and separating methacrolein oxime. 2,494,859. Rohm & Haas Co.

Di-n-butylamino malonic acid-ethyl-diethylaminoethyl ester. 2,494,875. Dr. A. Wander A. G.

Preparing allyl beta-alloxypropionate by reacting a salt of hydracrylic acid and an alkyl halide. 2,494,880. Rohm & Haas Co.

Glycol alginates. 2,494,911. Kelco Co.

Higher alkylene glycol esters of alginic acid. 2,494,912. Kelco Co.

Iodinated sulfonamide. 2,494,930. Ramon de Montaner.

N^4-acetyl, N^1-(p-iodophenyl) sulfanilamide. 2,494,931. Ramon de Montaner.

Condensation products by heating a primary amide of an aliphatic carboxylic acid having 12 to 18 carbon atoms with thioglycolic acid and with an unsaturated aliphatic aldehyde, crotonic aldehyde or acrolein until the reaction product is soluble in dilute sodium carbonate solution and heating the product with a water-soluble primary sulfite. 2,494,966. Ciba Ltd.

Preparing an alkoxyborohydride by reacting a hydride of a metal of the group consisting of alkali and alkaline earth metals and an alcohol ester of boric acid. 2,494,968. U. S. A. as represented by the Director of the Office of Scientific Research and Development.

Production of a monochloro-cresol by introducing chlorine into a solventless molten cresol. 2,494,993. Imperial Chemical Industries Ltd.

1,2-dihydrobenzo-(f)quinolin-3-ol, by heating 1-cyanoethyl-2-naphthol with bisulfite under pressure. 2,495,048. General Aniline & Film Corp.

Obtaining a pure 2:7 diamino-9-phenyl-10-alkyl phenanthridinium salt from the solution resulting from the reduction in the solution of a 2:7-dinitro-9-phenyl-10-alkyl phenanthridinium salt. 2,495,051. May & Baker Ltd.

Production of glycerin and distilled fatty acids wherein water and fat are subjected to countercurrent hydrolysis at effectively high temperature and high pressure in the presence of a water-insoluble metal soap catalyst. 2,495,071. Procter & Gamble Co.

Producing an N-mono substituted sulfenamide by reacting a hypohalite of the class consisting of the alkali metal and alkaline earth metal hypohalites with a primary amine to produce an N-monochloro primary amine and mixing the resultant reaction mixture and a mercaptide of the class consisting of the alkali metal and alkaline earth metal mercaptides. 2,495,085. Firestone Tire & Rubber Co.

Paper & Pulp

Improving the stability of paper against aging by impregnating with an aqueous solution of a member selected from the group consisting of ammonium and alkali metal salts of dicyanimide. 2,492,821. American Cyanamid Co.

Improving the stability of paper against aging by impregnating with an aqueous solution of a member selected from a group consisting of ammonium and alkali metal salts of dicyanoguanidine. 2,492,822. American Cyanamid Co.

Insulating paper of asbestos and bentonite. 2,493,604. General Electric Co.

Bleaching ligneous cellulosic materials by treating with a bleaching agent selected from the class consisting of chlorine, hypochlorous acid, and alkali metal and alkaline earth hypochlorites; treating said preliminary bleached cellulosic material with chlorine dioxide; and then subjecting said bleached cellulosic material to the action of a peroxide bleaching agent. 2,494,542. Niagara Alkali Co.

Petroleum

Lubricating oil composition comprising a hydrocarbon lubricating oil blended with a polybutene, a polyacrylate, and dibutoxy ethyl phthalate. 2,492,789. Jasco, Inc.

Mineral oil composition comprising a mineral oil fraction in admixture with triethyllead caproate. 2,493,213. Socony-Vacuum Oil Co., Inc.

Mineral oil composition comprising a viscous mineral oil fraction in admixture with an oil-soluble metal sulfonate; an oil-soluble, phosphorus- and sulfur-containing reaction product obtained by reaction of a phosphorus sulfide and a material selected from the group consisting of a dicyclic terpene and an essential oil predominantly comprised of a dicyclic terpene and an oil-soluble, phosphorus- and sulfur-containing reaction product obtained by reaction of phosphorus pentasulfide and oleyl alcohol. 2,493,216. Socony-Vacuum Oil Co., Inc.

Mineral oil composition comprising a viscous mineral oil fraction in admixture with: an oil-soluble, sulfurized metal carboxylate; and an oil-soluble, phosphorus-and sulfur-containing reaction product obtained by reaction of a phosphorus sulfide and a material selected from the group consisting of a dicyclic terpene. 2,493,217. Socony-Vacuum Oil Co., Inc.

Continuous cyclic process for the catalytic conversion of hydrocarbons. 2,493,219. Socony-Vacuum Oil Co., Inc.

Alkylation of hydrocarbons in the presence of a hydrofluoric acid catalyst. 2,493,384. Phillips Petroleum Co.

Gas processing for the synthesis of hydrocarbons. 2,493,454. Stanolind Oil & Gas Co.

Azeotropic distillation of hydrocarbons with sulfur dioxide. 2,493,537. Texas Co.

In refinement of mineral lubricating oils which contain impurities of the character of asphaltic substances, wherein the oils are subjected to solvent extraction, the improvement which comprises treating said mineral oil with a minor but asphalt-precipitating amount of antimony trichloride as precipitating agent. 2,493,596. Shell Development Co.

Converting higher boiling hydrocarbon to lower boiling products by cracking in the presence of a silica-free catalyst comprising alumina and beryllium fluoride. 2,493,761. Standard Oil Co.

Extreme pressure lubricants consisting of petroleum base oil containing a material having the general formula $R_1S\text{-}PS(OR_2)(OR_3)$ wherein R_1 is a halogenated rosin ester, and R_2 and R_3 are aliphatic hydrocarbon groups of 2 to 10 carbon atoms each. 2,494,332. Standard Oil Development Co.

Lubricant comprising a major proportion of a waxy mineral lubricating oil and a pour-depressing amount of an oil-soluble condensation product of an alkyl mercaptan having from 1 to 20 carbon atoms, with an aromatic compound having less than 20 carbon atoms and selected from the class consisting of aromatic hydrocarbons and hydroxy derivatives thereof. 2,494,341. Stanadrd Oil Development Co.

Removing salt water from petroleum emulsions in which the salt water is contained as the disperse phase, by passing the emulsion at 200° to 400° F., through a series of individually supported beds of closely packed glass fibers. 2,494,392. Texas A. and M. Research Foundation.

Polymerizing propylene to form normally liquid hydrocarbons useful as a motor fuel component, by contacting propylene, in the presence of isobutane and substantially free of butylene, with a copper pyrophosphate polymerization catalyst. 2,494,510. Polymerization Process Corp.

Separating a mixture of hydrocarbons consisting of butene-1 and butene-2 by contacting said mixture with a cuprous ammonium salt to form an extract solution containing the butene-1 and a raffinate fraction containing the butene-2. 2,494,546. Standard Oil Development Co.

Treating clay catalysts used for conversion of sulfur containing feeds. 2,494,556. Houdry Process Corp.

Cracking hydrocarbons with modified kaolin catalyst. 2,494,586. Houdry Process Corp.

Sulfiding natural absorptive hydrosilicate of aluminum containing iron with dilute sulfiding gas by contacting with a heated flue gas containing a minor proportion of free hydrogen and having added elemental sulfur suspended in said flue gas. 2,494,587. Houdry Process Corp.

Pyrolytic conversion of hydrocarbons with recovery of coke. 2,494,695. Sinclair Refining Co.

Emulsion consisting of water and bituminous material in which water is the continuous phase stabilized by ammonium-ligno-sulfonate. 2,494,708. Donald C. Jesseph.

Cracking a hydrocarbon oil by contacting vapors with heated catalyst pellets. 2,494,794. Gulf Oil Corp.

Removal of fluorine from organic materials by fractional distillation to separate purified hydrogen fluoride subjecting residual liquid fluorine-containing organic impurities to an elevated temperature to decompose the same, forming hydrogen fluoride and recovering hydrogen fluoride so formed. 2,494,867. Phillips Petroleum Co.

Treating hydrocarbons with hydrofluoric acid. 2,495,133. Pan American Refining Corp.

Photographic

Treating the gelatine in photographic emulsions by immersing a medium carrying a gelatine emulsion in a solution containing formaldehyde and aminoacetic acid, whereby formaldehyde acts as an agent for artificially aging or hardening said gelatine, and said acid acts to neutralize the residual formaldehyde remaining in said emulsion. 2,493,838. Bennett F. Terry.

Gelatin derivative resulting from heating gelatin and the halide of a furoic acid. 2,494,041. Eastman Kodak Co.

Light-sensitive photographic element comprising a cellulose ester film carrying a silver halide emulsion layer and succinonitrile. 2,494,054. Eastman Kodak Co.

Hardening of photographic silver halide gelatin emulsions with nitro alcohols. 2,494,055. General Aniline & Film Corp.

Forming a photographic relief image by developing a gelatino-silver halide emulsion layer to form a silver image, bleaching to silver bromide in a hydrogen peroxide-bromide bleach without dissolving but with softening the gelatin in the region of the silver image, hardening prior to bleaching, washing off the gelatin softened by the bleach bath in warm water, to form a positive gelatino-silver halide relief image. 2,494,068. Eastman Kodak Co.

Treating the surfaces of aluminum plates for silver halide emulsion coating, by action of a solution of water and disodium phosphate. 2,494,729. Bennett F. Terry.

Chemical erasing of photographic silver images by applying a solution containing cupric chloride and ammonium chloride, treating the area to which the cupric chloride solution was applied with thiourea. 2,494,765. Keuffel & Esser Co.

Cyan component for diazotype color process. 2,494,906. General Aniline & Film Corp.

Azo dyestuff images from N-acyl-N-aryl hydrazine developers. 2,495,000. General Aniline & Film Corp.

Polymers

A copolymer of vinyl chloride with acrylonitrile plasticized with a compound selected from the group consisting of: thymol, isothymol, orcinol, methylene di-salicylic acid, 2-methyl-3,5-di-isopropyl phenol, mixtures of alkylated phenols, p-chlorophenol, 2,4-dichlorophenol, and 1,3-dihydroxy-4-chlorobenzene. 2,492,419. American Viscose Corp.

Composition comprising a copolymer of vinyl chloride with acrylonitrile containing a monohydric alcohol having between 5 and 9 carbon atoms. 2,492,420. American Viscose Corp.

Conversion of a liquid polymeric iso-olefin, comprising heating in admixture with molecular iodine. 2,492,844. Phillips Petroleum Co.

Producing thermosetting polyaryl-biguanide-formaldehyde resins, by reacting formaldehyde with an aromatic amine and selected from the group consisting of primary and secondary arylamines of the formula $RNHR'$, in which R stands for a member of the group consisting of aryl and halogenated aryl radicals and R' stands for a member of the group consisting of hydrogen, lower alkyl and aryl radicals and halogenated lower alkyl and halogenated aryl radicals in an acid medium reacting the reaction product with dicyandiamide. 2,492,855. General Aniline & Film Corp.

Polymerization of vinyl esters in solution in dioxane, tetrahydrofuran, or tetrahydropyran. 2,492,929. E. I. du Pont de Nemours & Co.

Polymerizing an organic compound containing the vinyl group and which is capable of being polymerized by a peroxide catalyst, in aqueous emulsion in the presence of a water-soluble salt of an amine selected from the group consisting of hydroabietylamine and dehydroabietylamine as emulsifying agent. 2,492,930. Hercules Powder Co.

Polyoxyalkylene compounds. 2,492,955. Shell Development Co.

Setting a fluid acid-settable resinous reaction mixture to solid form, by a catalytic amount of a compound whose formula is X COOR wherein X represents a halogen atom and R is an organic radical that does not prevent hydrolysis of the compound to form a hydrogen halide. 2,493,075. Pennsylvania Salt Mfg. Co.

In forming a resinous product by conjointly polymerizing a mixture of styrene and an ester of endomethylene tetrahydrophthalic acid and a glycol of a class consisting of diethylene glycol and triethylene glycol, the steps of maintaining the mixture in intimate contact with oxygen prior to polymerization. 2,493,343. Pittsburgh Plate Glass Co.

Polymeric addition products of reactive methylenic compounds and sulfone-activated ethylenic compounds. 2,493,364. U. S. Rubber Co.

Improving the properties of the product of the polymerization of a composition comprising a substance containing a halogen atom and a polymerizable carbon-to-carbon double bond by subjecting it to intimate contact with an inorganic peroxide and an ester of an oxyacid of phosphorus. 2,493,390. Stabelan Chemical Co.

Reclaiming vulcanized polymers by treatment with metalloid hydrides. 2,493,518. Standard Oil Development Co.

Hydrogenated polymer of 2-vinyldibenzofuran. 2,493,584. General Electric Co.

Use of phosphite esters in the stabilization of linear polyamides. 2,493,597. Rohm & Haas Co.

Copolymers of diallyl fumarate and styrene. 2,493,948. Catalin Corp.

Producing a polystyrene emulsion having high solids content by heating a mixture of styrene and plasticizer selected from the group consisting of dialkyl phthalates, diaryl phthalates and triaryl phosphates. 2,493,965. U. S. Rubber Co.

Polymerizable, acid-curing, thermosetting resin selected from the group consisting of melamine-formaldehyde and urea-formaldehyde resins and endomethylene tetrahydrophthalic anhydride. 2,494,095. American Cyanamid Co.

Resinous epoxides and aromatic sulfonamide-aldehyde condensates. 2,494,295. Devoe & Raynolds Co., Inc.

Producing granular polymer of vinyl chloride by agitating and polymerizing dispersed liquid vinyl chloride in an aqueous alcohol medium, the reaction mixture containing a peroxide polymerization catalyst soluble in liquid vinyl chloride, a methyl ether of a polysaccharide, and water containing a saturated monohydric alcohol of 1 to 2 carbon atoms. 2,494,517. Shell Development Co.

Process of preparing a water, acid, and alkali resistant, hard resinous material which comprises dissolving alkali soluble lignin and partially polymerizing furfuryl alcohol in a common solvent chosen from the group consisting of monoalkyl ethers of ethylene glycol, diethylene glycol, ethers of diethylene glycol and tetrahydrofurfuryl alcohol to form a solution, heating the materials to react the lignin and partially polymerized furfuryl alcohol. 2,494,545. Masonite Corp.

Copolymerization of an isoolefinic hydrocarbon of 4 to 7 carbon atoms with a polyolefinic hydrocarbon of 4 to 14 carbon atoms by kneading the mixture in the presence of a Friedel-Crafts catalyst and a chlorofluoro alkane which is solid at the reaction temperature. 2,494,585. Standard Oil Development Co.

Reacting a copolymer of a mono-olefinic aromatic compound containing 8 to 13 carbon atoms of which 6 to 10 are part of the aromatic nucleus and an aliphatic mono-olefin of 3 to 8 carbon atoms, with a reagent comprising phosphorus and also comprising sulfur. 2,494,592. Standard Oil Development Co.

Producing sub-resinous and resinous materials by reacting aromatic hydrocarbons with formaldehyde in the absence of a substantial amount of water, in the presence of glauconite. 2,494,758. Socony-Vacuum Oil.

Polymerizing styrene in iron vessels. 2,494,924. Dow Chemical Co.

Aryl phosphate of polyvinyl alcohol. 2,495,108. Monsanto Chemical Co.

Dissolving low viscosity diolefin polymers. 2,495,135. Firestone Tire & Rubber Co.

Polymerizing butadiene. 2,495,137. Firestone Tire & Rubber Co.

Resinous reaction product derived by heating an unsaturated acidic compound selected from the group consisting of maleic acid, fumaric acid, maleic anhydride and the monomethyl substitution derivatives for the non-carboxyl hydrogen thereof, adipic acid, succinic acid, hydrocarbon primary diamine, and saturated glycol. 2,495,172. Westinghouse Electric Corp.

Rubber

Preparing a synthetic rubber by heating a mixture of an alkyl acrylate and a polyolefinic ether selected from the group consisting of divinyl ether, diallyl ether, and dimethallyl ether, compounding with sulfur, and heating to effect vulcanization. 2,492,169. U.S.A. as represented by the Secretary of Agriculture.

Preparing a copolymer comprising alkyl acrylate, and a haloalkyl acrylate. 2,492,170. U.S.A. as represented by the Secretary of Agriculture.

In production of synthetic rubber by emulsion copolymerization of butadiene and styrene, the improvement which comprises copolymerizing butadiene and styrene while present as a dispersed phase in an aqueous emulsion in the presence of tertiary hexadecyl mercaptans, producing a gel-free polymeric product the components of which have a uniform intrinsic viscosity. 2,493,268. Phillips Petroleum Co.

Producing polychloroprene lactices which are suitable for the impregnation of paper, as blending agents for conventional polychloroprene latices and for production of films by polymerizing in an alkaline aqueous emulsion and in the presence of a chloroprene polymerization catalyst chloroprene containing a rosin ester obtained from an alcohol containing not more than 5 carbon atoms and not more than 4 hydroxyl groups, a water soluble salt of a rosin acid being employed as the emulsifying agent. 2,493,798. E. I. du Pont de Nemours & Co.

Increasing the plasticity of an elastoprene of the class consisting of natural rubber and the polymers of 1,3-butadiene and of 2-chloro-1,3-butadiene by incorporating in the unvulcanized form an anilide of a betaketo acid of the formula $R\text{-}CO\text{-}CH_2\text{-}CO\text{-}NHR'$, wherein R stands for a radical of the group consisting of phenyl and naphthyl radicals and alkyl radicals of from 1 to 6 carbon atoms and R' stands for a radical of the group consisting of phenyl and naphthyl radicals. 2,493,843. E. I. du Pont de Nemours & Co.

Creaming of mixtures of synthetic rubber latices of different average particle sizes. 2,494,002. U. S. Rubber Co.

Preparing polychloroprene by emulsion polymerization of chloroprene which contains carbonyl compounds as impurities in the presence of an alkyl mercaptan, in an aqueous alkaline emulsion containing a reducing agent selected from the group consisting of hydroxylamine, hydrazine, water-soluble sulfides, water-soluble hydrosulfites and water-soluble normal sulfites. 2,494,087. E. I. du Pont de Nemours & Co.

In manufacture of synthetic rubber-like materials by polymerization in aqueous emulsion of a conjugated diolefin having from 4 to 6 carbon atoms per molecule, the improvement which comprises using as polymerization modifier an aliphatic mercaptan mixture consisting of dodecyl, tetradecyl and hexadecyl mercaptan. 2,494,526. Standard Oil Development Co.

Plasticizing vulcanized rubberlike diolefine polymer material by heating in the presence of a thiophene compound and kneading. 2,494,593. U. S. Rubber Reclaiming Co., Inc.

Milling isobutylene-multiolefin copolymer synthetic rubber prior to curing. 2,494,766. Jasco, Inc.

Producing sponge by mixing with a latex the rubber-like content of which includes nothing but natural rubber and rubber-like polymerized chloroprene and all vulcanizing reagents except zinc oxide. 2,495,097. Firestone Tire & Rubber Co.

Cured high carbon, flexible, rubber composition which contains rubber isobutene polymerized in the presence of a diolefin, reinforcing carbon black, and cacao butter. 2,495,099. Firestone Tire & Rubber Co.

Treating synthetic rubber coagulant effluent to recover aluminum salts. 2,495,120. Firestone Tire & Rubber Co.

Latex creaming in the presence of dibasic sodium phosphate. 2,495,141. Firestone Tire & Rubber Co.

Tacky rubbery composition containing a resinous reaction product of sulfur dichloride and a phenol. 2,495,145. Firestone Tire & Rubber Co.

Specialties

Primary cell characterized by its high flash current and efficiency at low temperature comprising a positive electrode consisting of a cobalt-coated aluminum support bearing a coating of lead dioxide, an electrolyte consisting of a solution of perchloric acid and a negative electrode consisting of aluminum coated with lead. 2,492,206. Joseph C. White, John H. Baldwin, Edward J. Peebles, and Wilson H. Power.

Liquid dielectric material consisting of an ingredient selected from the class consisting of tetrahydro furfuryl benzoate, amyl trichlor benzoate, isopropyl benzoate, and benzyl benzoate. 2,492,210. General Electric Co.

Stabilizing an organic material subject to oxidative deterioration by adding an inhibitor comprising a ketone having a sulfur atom attached to the carbon atom beta to the keto group. 2,492,334. Universal Oil Products Co.

Stabilizing an organic material subject to oxidative deterioration by adding an inhibitor of the following formula, $X(CR'R''\text{-}CH_2\text{-}CRO)_2$, in which R, R' and R'' are selected from the group consisting of hydrogen, alkyl, alkenyl, aryl, alkaryl, aralkyl, cycloalkyl and heterocyclic ring radicals, and in which X is a hydrocarbon group in which sulfur atoms are attached to different carbon atoms. 2,492,335. Universal Oil Products Co.

Stabilizing an organic material subject to oxidative deterioration by adding an inhibitor comprising a bis-(γ-ketoalkyl) **sulfide**. 2,492,336. Universal Oil Products Co.

In production of an acid-resisting cement from waterglass, adding to a soda waterglass a water-soluble fatty acid ester of a polyhydric alcohol selected from the group consisting of glycerol and glycol. 2,492,790. Ladislaw Vilmos Farkas, and Michael Mojzesz Szwarc (1/2 to Ellis Foster Co.).

Incorporating a low alkyl ester of gallic acid in a fatty material as a synergistic antioxidant. 2,493,288. Griffith Labs., Inc.

Aqueous composition for treating iron and steel which consists of an aqueous solution including phosphoric acid; formic acid; zinc; ethylene glycol monobutyl ether; wetting agent, and water. 2,493,327. Kelite Products, Inc.

Brazing flux comprising zinc chloride, ammonium chloride, cryolithionite and diethylene glycol monoethyl ether. 2,493,372. Harold R. Williams.

Prevention of foaming in steam generation with a linear condensation product of one molecular proportion of ethylene diamine and two molecular proportions of a dimer of an unsaturated higher fatty acid derived from a member of the group consisting of linseed oil fatty acids and soy bean oil fatty acids, and boiling. 2,493,453. Dearborn Chemical Co.

Inhibiting the tendency of corrosive brines containing low-boiling organic acids to attack metal surfaces by **mixing with bone oil. 2,493,462.** Stanolind Oil & Gas Co.

Quick-drying writing ink comprising in solution a copper phthalocyanine of the benzene series having attached to the phenylene nuclei a plurality of aliphatic sulfonamide groups, a hydroscopic polyhydric alcohol, water and caustic alkali. 2,493,724. General Aniline & Film Corp.

Waterproofing mineral wool with an oleaginous liquid coating material, and thereafter distributing onto said coated fibers a minor proportion of a powdered, water-repellent material selected from the group consisting of waxes, soap-forming fatty acids and metallic salts of soap-forming fatty acids. 2,493,845. Johns-Manville Corp.

Flame, oil and gasoline resistant sealing composition comprising a water dispersion of polyethylene formal polysulfide, a water dispersion of carbon black, a water dispersion of zinc chromate and asbestos fibre. 2,494,336. Rohr Aircraft Corp.

Preparing briquettes of blast furnace flue dust, by combining with flue dust a resinous acid sludge obtained by treating coke oven light oil with sulfuric acid. 2,494,420. Carnegie-Illinois Steel Corp.

Preparing a cold setting glue by reacting resorcinol with formaldehyde in the presence of an acid catalyst. 2,494,537. U.S.A. as represented by the Secretary of Agriculture.

Peanut preparation stabilized against rancidity comprising peanuts and an external coating of salt containing an inhibitor selected from the group which consists of ascorbic acid, salts of ascorbic acid and esters thereof. 2,494,717. Merck & Co., Inc.

Glue for uniting paper to wood veneer which includes fine mesh soya bean flour; sodium hydroxide; coal tar hydrocarbon-soluble, gasoline-insoluble resin from southern long-leaf pine. **2,494,744.** Chicago Mill and Lumber Co.

Briquette consisting of silver alumino silicate and a disrupter capable of disintegrating said briquette quickly when immersed in seawater, comprising wilkinite. 2,494,784. Permutit Co.

Tape having on one face a latex-base pressure-sensitive adhesive and on the other face a thermo-plastic backing non-blocking to said **adhesive**; said backing comprising a glycol ester of a hydrogenated rosin, a paraffin wax and diamine polyamides of polymerized octadecaienoic acids. 2,495,008. American-Marietta Co.

Flushing oil consisting of a catalytic reformed naphtha fraction, mono- and polymethylated aromatic hydrocarbons, a phosphorus- and sulfur-containing reaction product of an olefin polymer and a phosphorus sulfide. 2,495,030. Standard Oil Co.

Polyhydroxybenzene-formaldehyde adhesive. 2,494,175. Westinghouse Electric Corp.

Textiles

Simultaneously lubricating and applying a fugitive tint to textile materials having a basis of an organic derivative of cellulose by applying a tinting medium comprising an acid tinting dyestuff, water, a lubricating oil and a quaternary ammonium salt. 2,492,394. Celanese Corp. of America.

Package comprising acidic fertilizer in a multi-ply wall paper bag having a sewed seam, sewed with cotton thread impregnated with triethanolamine. 2,493,031. U. S. A. as represented by the Secretary of Agriculture.

Rendering textile materials permanently water repellent by impregnating with an aqueous alkaline dispersion, in which the major proportion of the alkaline material is ammonia, of the complex reaction product secured by reacting under substantially anhydrous conditions an aliphatic acid nitrile with a material which furnishes formaldehyde in the presence of a catalytic amount of an acid selected from the group consisting of sulfuric acid and chlorosulfonic acid to secure an intermediate product, and reacting said intermediate product with phosphorus trichloride. 2,493,360. Sun Chmeical Corp.

Crease-proofing textile fabrics by applying an aqueous solution of a thermosetting polymerizable resin, and insolubilizing the resin in the presence of an acid catalyst. 2,493,381. U. S. Finishing Co.

Shrinkproofing wool by heating in a bath of morpholine. 2,493,765. George C. Le Compte.

Preparing fire-resistant, light colored, opaque **window shade material**, by dyeing woven cotton sheeting black, coating said dyed sheeting on each side with a composition comprising polyvinyl chloride resin, antimony oxide and plasticizer dispersed in a volatile liquid. 2,494,391. E. I. du Pont de Nemours & Co.

Tire fabric having a weft composed of a fibre-forming homopolymer of ethylene and a warp of continuous filament yarns of regenerated cellulose. 2,494,649. Celanese Corp. of America.

Water, Sewage, etc.

Water treating composition consisting of a sodium phosphate glass. 2,494,828. Hall Labs., Inc.

Agricultural *

Preparing a reaction product having useful insecticidal properties by heating a phosphate from the group consisting of the lower alkyl phosphates and the lower alkyl thiophosphates, and at least one sulfur acid halide to liberate the sulfur and halogen contained in said sulfur acid halide. 2,495,220. Eastman Kodak Co.

Phenothiazine drench compositions containing diphenylamine and a monomeric non-ionic, mono-hydroxy aliphatic alcohol containing from 8 to 14 carbon atoms, and a non-amylaceous, non-ionic, high molecular weight water-soluble, polyhydroxylic polymer. 2,495,270. E. I. du Pont de Nemours & Co.

Cellulose *

Cellulose derivative in which the molecular chains of cellulose are chemically united by resinified bridge linkages formed by the reaction of hydroxyl groups of the original material with a non-resinous polymethylolphenal reagent. 2,495,232. Comptoir des Textiles Artificiels.

Impregnating a preformed cellulosic structure containing free hydroxyl groups with a non-resinous polymethylolphenol reagent capable of forming resiniform bridge linkages between cellulose chains. 2,495,233. Comptoir des Textiles Artificiels.

Subjecting a dense mass of cellulosic material, having free hydroxyl groups and having incorporated therein a non-resinous polymethylolphenol to dry saturated steam under pressure. 2,495,234. Comptoir des Textiles Artificiels.

Preparation of viscose in a kneading and crushing device, which comprises adding carbon disulfide and water to a mass of alkali cellulose. 2,495,235. Societe de Constructions Mecaniques de Stains.

Treating cellulose by condensing in alkaline medium p-tert-amyl-phenol and formaldehyde and reacting the condensation product with cellulosic material containing free hydroxyl groups and subjecting the reaction products to thermal treatment to form resiniform bridge linkages between the cellulose chains. 2,495,239. Comptoir des Textiles Artificiels.

Cellulose derivative plasticized with an oily diester of a polyhydric alcohol. 2,495,714. Baker Castor Oil Co.

Morpholine derivatives in viscose spinning. 2,495,833. Atlas Powder Co.

Recovering chemicals in the manufacture of cellulose by digestion according to the alkaline sulfite and/or alkaline bisulfite methods. 2,496,550. Stora Kopparbergs Bergslags Aktiebolag.

Ceramics *

Optical glass resulting from fusion of fluoride chosen from the group consisting of the fluorides of lithium and sodium; ferric oxide; aluminum metaphosphate. 2,496,824. Eastman Kodak Co.

Detergents *

In a continuous soap making process: liquefying a sapon-fiable fat by adding a hydrocarbon diluent having a vapor pressure approximately that of undecane; adding a water solution of alkali to saponify said fat; saponifying by passing through a restricted passage at an elevated temperature; ejecting into a region of diminished pressure whereby said glycerine, said water and said hydrocarbon are vaporized, said glycerine, water and hydrocarbon vapor mixture having a vapor pressure approximately twice the vapor pressure of the hydrocarbon at the glycerine condensing temperature; separating said vapors; condensing glycerine from the vapor system; and subsequently separately condensing the hydrocarbon and water. 2,496,576. Swift & Co.

Dyes & Pigments *

Esterlike derivatives of azo dyestuffs. 2,495,243. Ciba Ltd.

Esterlike derivatives of azo dyestuffs. 2,495,244. Ciba Ltd.

Dyeing organic acid ester of cellulose textile materials with an aqueous solution of a normally acid-fading dyestuff, lower aliphatic alcohol, thiocyanate, and alkali metal hydroxide. 2,495,810. Celanese Corp. of America.

Azo dyestuffs being diazotized 4-amino-3-pentadecyl phenol coupled with 3-pentadecyl phenol. 2,496,151. Harvel Corp.

Azo dyes. 2,496,255. General Aniline & Film Corp.

Production of fast dyeings on wool by dyeing with an ester of a monoazo dyestuff. 2,496,386. Ciba Ltd.

Anthraquinone dyestuffs. 2,496,414. Celanese Corp. of America.

Preparation of cadmium sulfoselenide pigments. 2,496,587. American Cyanamid Co.

Controlled flux in calcining cadmium pigment crude. 2,496,588. American Cyanamid Co.

Cyanamine dye intermediates containing an aryloxy-, arylthio- or arylselonalkyl-p-toluene sulfonate group attached to the nitrogen atom thereof. 2,496,842. General Aniline & Film Corp.

Azamerocyanine dyes and a process for the preparation thereof. 2,496,899. General Aniline & Film Corp.

Inorganic *

Purifying a solution of manganese and ammonium salts containing traces of nickel, copper and cobalt, by introducing sulfide ion to convert the nickel, copper and cobalt into their sulfides; and filtering. 2,495,456. Crimora Research and Development Corp.

Rectifying a molten halide salt bath by addition of a compound, composed of fluorine and boron, carbon hydrogen, or silicon. 2,495,471. Heathath Corp.

Separating a ternary gaseous mixture containing hydrogen and methane and a constituent having an intermediate boiling point to recover the hydrogen and methane therefrom. 2,495,549. Elliott Co.

Recovering solid potassium perchlorate and solid sodium sulfate from a sulphuric acid slurry by filtration, adding water to bring all the sulfate into solution, separating the solid potassium perchlorate by filtration, cooling the sodium sulfate solution to cause precipitation of sodium sulfate decahydrate, and separating. 2,496,287. Cardox Corp.

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* From Vol. 630, Nos. 4, 5; Vol. 631, No. 1.

Separation of sodium chlorite and potassium chlorate by evaporating the solution to crystallize potassium chlorate until the solution reaches the eutectic composition, separating the crystallized potassium chlorate, cooling to crystallize a mixture of potassium chlorate and $NaClO_2 \cdot 3H_2O$, separating the mixture from the mother liquor, heating to dissolve the potassium chlorate and to form a slurry of solid anhydrous sodium chlorite and separating the solid sodium chlorite. 2,496,288. Cardox Corp.

Recovery of sodium chlorite, potassium chlorate and sodium chloride by crystallization. 2,496,289. Cardox Corp.

Separating sodium chlorite, potassium chlorate and calcium sulfate comprising: regulating the water content of the mixture to insure retaining the sodium chlorite and potassium chlorate in solution, filtering calcium sulfate, concentrating the filtrate by evaporation until saturated as to sodium chlorite, then filtering out potassium chlorate, again concentrating the solution by evaporation until saturated with potassium chlorate, whereby there is precipitated a mixture of sodium chlorite and calcium sulphate, and thereafter separating the precipitated mixture from the solution. 2,496,290. Cardox Corp.

Preparation of a mixture which may be pelleted to form cupric oxide pellets. 2,496,353. Air Reduction Co., Inc.

Manufacture of inorganic oxide spherical particles. 2,496,396. Universal Oil Products Co.

Preparing precipitated silica characterized by high oil adsorptivity, by bringing an alkali metal silcate into contact with sulfuric acid. 2,496,736. William T. Maloney.

Refining rutile by sintering with finely divided alkali to form titanate, eliminating chromium by the presence of an inorganic halide, washing, dissolving the residue in concentrated sulfuric acid and then recovering TiO_2 by hydrolysis. 2,496,993. Ferro Enamel Corp.

Leather *

Tanning by subjecting a skin to action of an aqueous alum salt tanning solution, then an acid-stable fat liquoring composition, said fat liquoring composition comprising a leather treating oil and a cationic surface active base compound. 2,496,640. Nopco Chemical Co.

Tanning by subjecting a skin to the action of an aqueous alum salt tanning solution, then subjecting the skin to the action of an acid-stable fat-liquoring composition in chemical emulsion in said tanning agent solution, comprising a leather treating oil and a cationic surface active base compound. 2,496,641. Nopco Chemical Co.

Metals *

In production of sponge iron, by forming a reducible mixture of iron ore and a carbonaceous reducing agent, adding thereto dolomite. 2,495,225. Russell C. Buehl, John P. Riott and Earle P. Shoub.

In electrowinning manganese from an alkaline electrolyte and employing stainless steel cathode plates; the step which consists in polishing and cleansing the surfaces of the cathodes; coating with films of a dilute solution of alkali silicate; submerging the film-coated cathodes; and depositing the metal thereon. 2,495,457. Crimora Research and Development Corp.

Stabilizing a pyrophoric reduced nickel catalyst by wetting with water to form an inert surface film thereon. 2,495,497. U.S.A. as represented by the U.S. Atomic Energy Commission.

Zinc electroplating from an alkaline zinc cyanide bath containing a reaction product of a heterocyclic aldehyde with a carbocyclic primary amine. 2,495,629. Poor & Co.

Electrodeposition of copper from an aqueous, alkaline bath which comprises copper cyanide, sodium cyanide, and an amount of a brightening additional agent of the class consisting of B-mercapto ethanol dithiodiglycol, B,B' dihydroxyethyl sulfide and thioglycollic acid sufficient to permit a brilliant cathodic deposit. 2,495,668. Harshaw Chemical Co.

Electroplating copper on aluminum by immersing at least two aluminum articles in a water solution of sulfuric acid and copper sulfate, applying an alternating current to the two articles as electrodes and forming an anodic coating thereon. 2,495,941. Reynolds Metals Co.

Beneficiating oxidized-iron ores by subjecting ore pulp to froth flotation in the presence of an anionic-type promoter, selected from the group consisting of the higher aliphatic fatty acids, resin acids, naphthenic acids, talloel, sulfonates of such acids, sodium, potassium and ammonium soaps and emulsions thereof and sulfonated petroleum hydrocarbons of the oil-soluble water dispersible mahogany acid and mahogany soap types and the water-soluble green acid and green soap types; collecting the resultant iron-minerals-rich froth concentrate; conditioning an aqueous pulp of the iron concentrate with a material selected from the group consisting of the alkali and alkaline-earth metal hydroxides and carbonates; and a water-soluble alkali phosphate as a surface-modifying agent; subjecting the conditioned concentrate to froth flotation in the presence of a cationic-type promoter, selected from the group consisting of the long-chain aliphatic amines containing 12-18 carbon atoms, quaternary "onium" compounds, and the polyalkylene-polyamine-reaction-products type and collecting the tailing which is rich in iron and low in gangue. 2,496,050. American Cyanamid Co.

Rendering an oxide coating chemically produced on an aluminum article more adsorptive to dyes by immersing in a solution of water and an ammonium compound from the group ammonium chloride, ammonium nitrate, ammonium formate, ammonium acetate and ammonium sulfamate. 2,496,649. Aluminum Co. of America.

Bath for depositing a brass coating by chemical displacement comprising sodium zincate, sodium hydroxide, copper cyanide, sodium cyanide, basic lead carbonate and water. 2,496,845. Chrysler Corp.

Coating an iron casting by heating the casting until it is white hot, allowing to cool to harden, applying a mixture of chromic oxide powder and aluminum powder to a surface of the hot casting, whereby a reaction occurs between the chromic oxide and aluminum powder mixture to provide a metallic coating on the casting. 2,496,971. Sol B. Wiczer.

Electrolytic recovery of zinc. 2,496,996. Hudson Bay Mining and Smelting Co., Ltd.

Organic *

Cyanoether esters of dihydric alcohols. 2,495,214. Armour and Co.

Producing an alkali arsenite and recovering phenols from a mixture containing alkali phenolates by adding arsenous oxide to react with the alkali phenolates and elevating the temperature to liberate the phenols. 2,495,215. George Lieberman.

In hydrogenating an anthraquinone compound to tertahydroanthrahydroquinone, the improvement which consists of using a porous nickel catalyst. 2,495,229. Buffalo Electro-Chemical Co., Inc.

Preparing crystalline sodium l-ascorbate by treating an aqueous methanolic solution of l-ascorbic acid with sodium bicarbonate to form sodium l-ascorbate, and thereafter adding methanol. 2,495,246. Hoffmann-La Roche Inc.

Preparing a cyclammonium quaternary salt by oxidizing with a halogen, an N,N-diarylthioamide in which the aryl groups contain a hydrogen atom attached to the aryl nucleus in at least one of the positions ortho to the amide nitrogen atom. 2,495,260. Bela Gaspar.

Dehydrogenating alkyl aromatic hydrocarbons by vaporizing the aromatic hydrocarbon, mixing the vapors with a large excess of steam and passing the steam-vapor mixture through a catalyst composed of bauxite having a minor proportion of alkali metal carbonate distributed therein. 2,495,278. Koppers Co., Inc.

Esters of pentaerythritol dehydration products. 2,495,305. Trojan Powder Co.

In condensation of acrolein with a monohydric saturated aliphatic alcohol in an alkaline reaction medium, the steps which comprise incorporating an acrolein polymerization inhibitor and effecting the condensation in an oxygen-free gaseous atmosphere. 2,495,313. Celanese Corp. of America.

Producing metal nitrodithioacetates, said metal being from the group consisting of copper and zinc and said nitrodithioacetates being from the group consisting of nitrodithioacetate, nitromethyldithioacetate, nitrodimethyldithioacetate and nitroethyldithioacetate, by mixing a nitrohydrocarbon of the group consisting of nitromethane, nitroethane, 1-nitropropane and 2-nitropropane with carbon disulfide in an aliphatic alcohol containing not more than 3 carbon atoms. 2,495,322. Allied Chemical & Dye Corp.

Alkylating a mono-cyclic aromatic hydrocarbon with an olefin by an olefin and hydrochloric acid gas containing a metal chloride catalyst. 2,495,323. Compagnie Francaise de Raffinage.

Partial oxidation of hydrocarbons. 2,495,332. Celanese Corp. of America.

Producing liquid condensable organic compounds from vegetable cellulosic material by impregnating with a caustic soda lye, treating in an autoclave, adding lime, drying and treating by pyrolysis. 2,495,396. Societe Pyreneenne de Carburants et Solvants.

Alkoxyphenylalkyl-alkyl amines. 2,495,404. J. R. Geigy A. G.

Production of a monofluoro derivative of a saturated aliphatic halo hydrocarbon by reacting an unsaturated halo hydrocarbon with anhydrous hydrogen fluoride in the presence of a stannic halide as catalyst. 2,495,407. Imperial Chemical Industries Ltd.

Production of nitro olefins by reacting a saturated aliphatic nitro hydrocarbon of 2 to 8 carbon atoms with a basic substance selected from the group consisting of ammonia and urea in the presence of an inert organic solvent. 2,495,424. Imperial Chemical Industries Ltd.

Recovering dichloroacetic acid from crude dichloroacetic acid by heating the crude acid with a lower aliphatic alcohol to convert the acids to the esters, drying and rectifying to separate substantially pure dichloroacetic acid ester. 2,495,440. Dow Chemical Co.

Thioethers of polyalkylated cyclic sulfones. 2,495,467. Shell Development Co.

Preparation of hydroquinone, by passing a gaseous mixture of hydrogen steam and quinone vapor over a hydrogenation catalyst. 2,495,521. Societe des Usines Chemiques Rhone-Poulenc.

Preparing phenylacetothiomorpholide by mixing styrene, sulfur, and morpholine. 2,495,567. Rohm & Haas Co.

Producing acetylene by incomplete combustion of hydrocarbons. 2,495,665. Danciger Oil & Refining Co.

Preparing lower alkyl esters of 3-hydroxy-11-keto-12-bromonorcholanic acid. 2,495,735. Research Corp.

Increasing the solubility of a low-methoxyl pectinic acid by contacting with gaseous ammonia as a neutralizing agent. 2,495,756. U. S. A. as represented by the Secretary of Agriculture.

Beta-(2-biphenyloxy) ethyl beta-haloalkyl amines. 2,495,772. Parke, Davis & Co.

Producing a C-nitroso diaryl-amine by reacting an alkali metal nitrite and an aliphatic alcohol media with an unsubstituted diarylamine in the presence of a chlorine containing compound selected from the class consisting of phosgene and thionyl chloride while utilizing said chlorine containing compound to react with the water present to generate hydrogen chloride. 2,495,774. General Aniline & Film Corp.

Chloroalkyl phosphorus oxy and sulfodichlorides. 2,495,799. Victor Chemical Works.

Decolorizing an organic material by extracting an organic material containing color bodies with a solvent consisting of a complex of boron fluoride with an oxygenated alkane compound having not more than about 5 carbon atoms in the alkyl group, in the presence of an aliphatic hydrocarbon diluent. 2,495,852. Standard Oil Co.

Production of aromatic keto alcohols by reacting oxygen and an alkyl aromatic ketone containing a secondary alkyl group in the presence of an oxidation catalyst. 2,495,904. Universal Oil Products Co.

Diallyl esters of phosphorus acid. 2,495,958. Rohm & Haas Co.

Iodinated hydroxyphenyl cycloalkyl carboxylic acids. 2,496,064. Jewish Hospital of Brooklyn Research Foundation, Inc.

Preparing 2,5,2'5'—tetrahalogeno-4,4'-divinyl-biphenyl by reacting 2,5,2'5'-tetrahalogeno-biphenyl with acetyl chloride in the presence of aluminum chloride to form 2,5,2'5'-tetrahalogeno-4,4'-diacetyl-biphenyl, reacting said 2,5,2'5'-tetrahalogeno-4,4'-diacetyl-biphenyl with aluminum isopropoxide to form 2,5,2'5'-tetrahalogeno-4,4'-di-(β-hydroxyethyl)-biphenyl, and reacting said 2,5,2'5'-tetrahalogeno-4,4'-di-(β-hydroxyethyl)-biphenyl in the presence of a dehydrating agent to form 2,5,2'5'-tetrahalogeno-4,4'-divinyl-biphenyl. 2,496,067. Radio Corp. of America.

Preparation of phenyl chloroformate by adding to a solution of phosgene a slurry containing anhydrous sodium phenolate. 2,496,091. U. S. Industrial Chemicals, Inc.

Reaction products of an aldehyde and a triazine derivative. 2,496,097. Amercian Cyanamid Co.

Separating cyclopentadiene from coke oven by-product light oil by passing a separated fraction into a polymerization zone to polymerize cyclopentadiene to dicyclopentadiene passing the effluent of the polymerization zone to a condensation zone wherein the effluent is reduced to a temperature below 170° C. but above 40° C. to condense the dicyclopentadiene. 2,496,107. National Steel Corp.

Purifying nicotinamide contaminated with nicotinic acid by suspending in a hydrocarbon solvent, treating with an amine inert to nicotinamide but reactive with nicotinic acid to form a nicotinic acid amine salt soluble in said solvent. 2,496,114. R. P. Scherer Corp.

Stabilizing and removing chemically combined residual hydrogen from a perfluoro oil by subjecting said perfluoro oil to treatment with fluorine. 2,496,115. U. S. A. as represented by the U. S. Atomic Energy Commission.

Preparation of a 2-substituted 5-oxopyrrolidine which comprises heating the neutral beta-hydromuconate of a primary alkylamine. 2,496,163. E. I. du Pont de Nemours & Co.

Preparing alkoxyisobutyraldoximes by reacting the dimeric addition product of isobutylene and a nitrosyl halide with a primary alcohol of one to four carbon atoms in the presence of an inorganic compound which is approximately neutral but which has capacity for neutralizing a strong acid from the group consisting of carbonates of the alkaline earth metals, bicarbonates of the alkali metals, monohydrogen phosphates of the alkali metals, and borax. 2,496,198. Rohm & Haas Co.

Azeotropic distillation of hydrocarbons from sulfolanes. 2,496,207. Shell Development Co.

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* From Vol. 630, Nos. 4, 5; Vol. 631, No. 1.

Chemical Industry Expansion

(Continued from page 677)

additional products undergoing field tests: Pentaerythritol to be produced at Agnew, Calif. this year. New plasticizers, emulsifiers and amines are in pilot plant production.

DAVISON CHEMICAL CORP.

(Year ended June 30, 1949)
Net Sales: $37.4 million.
Expansion: $2.4 million.
Facilities Expanded: New facilities include a flotation plant for increased high grade phosphate rock recovery, new phosphate rock land, additional superphosphate and fertilizer facilities at Perry, Iowa, and a specialty catalyst plant. Synthetic catalyst expansion at Cincinnati begun.
Research: $562,000. Staff increased. Emphasis on existing basic products and process improvement. Synthetic gel-type cracking catalyst processes improved.

DEWEY AND ALMY CHEMICAL CO.

Foreign Expansion: Naples, Italy plant for can sealing compounds and air entraining agents for concrete rebuilt. Darex, S. R. L. formed in France with French interests to make sealing compounds, air entraining agents for concrete, and soda lime. Over 50% of stock received for patents and know-how. French government to permit conversion of dividends into dollars.

DOW CHEMICAL CO.

(Year Ended May 31, 1949)
Sales: $200 million.
Expansion: $37 million.
Facilities Expanded: Facilities completed included a large 2,4-D plant at Midland, 5 million lb/mo. vinyl-vinylidene chloride plant in Texas, 30% west coast chlorine-caustic expansion, bromine plant at Ludington, chlorine-caustic plant by Dow Chemical of Canada. Added facilities provided at Midland for Saran, ion exchange resins, phenol; and at Seal Beach, Cal., for agricultural chemicals. Methionine plant under construction at Pittsburg, Cal. New plant to increase xanthate production 20% reported. $8 million power plant under construction. Purchases from U. S. Government included its remaining interest in Freeport, Texas magnesium facilities and joint fresh water project, also 687 acres of land near Velasco, Texas. Proposed ethylene plant abandoned with a writeoff of $2 million. Brazos Oil and Gas activities extended to Michigan and California.

E. I. DU PONT DE NEMOURS & CO., INC.

Net Sales: $1025 million.
Expansion: $86 million.
Facilities Expanded: Nylon products, titanium pigments, polyvinyl alcohol, "Cordura" rayon tire yarn, and methanol. Construction begun on "Orlon" acrylic fiber plant at Camden, S. C. General Motors' 49% interest in Kinetic Chemicals ("Freon" producers) purchased for $9.7 million.
Research: $30 million post-war expansion of Experimental Station near Wilmington now 70% complete and scheduled for completion in late 1950. Completion of company-wide facilities expansion program in 1951 will permit a staff of 1800 technical personnel.

HARSHAW CHEMICAL COMPANY

(Year Ended Sept. 30, 1949)
Net Sales: $34.1 million.
Expansion: $530,000.
Facilities Expanded: Gloucester City drier plant completed. New warehouses leased at Cleveland, Chicago and Houston. El Segundo, Cal. antimony plant shut down and production of the oxide and metal discontinued.
1950 Plans: With exception of the Gloucester City glycerine plant, all capital expenditure appropriations discontinued.
Research: New metal soaps and pigment laboratory completed. New improved nickel plating process developed.

HERCULES POWDER CO.

Sales: $126 million.
Expansion: $7.4 million.
Facilities Expanded: One CMC (cellulose gum) increase completed and one nearing completion. California anhydrous ammonia and ammonium sulfate capacity expanded. Toxaphene additions will increase 1949 production 50%. Rosin amine unit completed. Tract purchased at Klamath Falls, Ore., for pilot plant to study chemicals from western woods. Anhydrous ammonia plant completed for Army at San Jacinto Ordnance Works.
1950 Plans: Expenditures to be somewhat higher and include Oregon pilot plant.
Research: $4.24 million. Emphasis on new cellulose derivatives, naval stores processing, coated paper adhesives, and wet-strength paper chemicals. New efficient wood waste combustion furnace developed. Rosin-based detergents and emulsifiers to be produced commercially early in 1950. Research for Navy at Alleghany Ballistics Laboratory.

HOOKER ELECTROCHEMICAL CO.

(Year ended Nov. 30)
Sales: $21.8 million.
Expansion: $2.0 million.
Facilities Expanded: Sodium trichloroacetate plant and antiseptic ingredient plant under construction. Plant adjoining Niagara plant purchased to provide buildings for expansion. Four new buildings constructed. Chlorinated products plant at Ashtabula, Ohio under construction by Hooker-Detrex, a joint subsidiary.
1950 Plans: Expenditures to be substantially higher with the major item expansion of the Tacoma plant. Some deferred 1949 projects also to be undertaken.
Research: Expenditures continued at 1948 rate, highest in company's history. Construction of a large pilot plant building underway at Niagara plant.

INTERNATIONAL MINERALS & CHEMICAL CORP.

(Year Ended June 30)
Net Sales: $53.4 million.
Expansion: $3.66 million.
Facilities Expanded: New drying, storage, and shipping facilities at Noralyn phosphate mine completed. Additions completed for refining potassium chloride and potassium sulfate at Carlsbad, also for mono sodium glutamate at San Jose, Calif. New matrix grinding and drying facilities at Wales, Tenn., and new plant food mixing plants at Somerset, Ky., and Winston Salem, N. C.
1950 Plans: No major construction projects presently in progress.
Research: Design of Chicago central research lab proceeding. Ready for large scale pilot plant are a new highly concentrated phosphatic plant food, a new phosphate animal feed supplement, and a new ore beneficiation and separation process. Research emphasis shifting to diversification. Triethyl glycine use in synthesis and in animal and human nutrition being studied.

KOPPERS CO., INC.

Sales: $191 million.
Expansion: $5.2 million.
Facilities Expanded: Increased investments in phthalic facilities by Koppers-Pittsburgh. Post-war expansion program substantially completed prior to 1949. Reed City, Mich. wood treating plant dismantled and equipment moved to new Richmond, Va. plant.
1950 Plans: No major Chemical Division expansion.
Research: Major efforts in the field of chemistry. Heat resistant polystyrene improved in clarity. 3 related polystyrenes scheduled for commercialization in 1950. Resorcinol production costs reduced. New line of chemical intermediates developed. In synthetic liquid fuels field, Louisiana, Mo. coal gasification plant constructed for Bureau of Mines.

LION OIL CO.

Expansion: $7 million.
Facilities Expanded: 4 of 6 major expansion projects were in Chemical Division. Anhydrous ammonia capacity increased 30% to 570 tons daily. 300 ton/day sulfuric acid and 380 ton/day ammonium sulfate plants completed. Ammonium nitrate finishing plant enlarged. Plant for asphalt specialties including protective coatings and rust preventives completed.
Research: Facilities expanded with added floor space and new equipment. Development of selective weed killing oil major activity. Cotton applications being tested at agricultural schools and experiment stations. Promising results with defoliating oils for sugar cane. Research on new fertilizers, solvents for agricultural applications, and new and improved insecticides.

MATHIESON CHEMICAL CORP.

Net Sales: $54.1 million.
Expansion: $30.2 million.
Facilities Expanded: Standard Wholesale Phosphate and Acid Works, Inc. and Southern Acid and Sulphur Co. acquired April 1, 1949. Other expansions: a new superphosphate and ammonium sulfate plant at Baltimore, new sodium nitrate plant and nitric acid plant rehabilitation at Lake Charles, and new sulfuric plants at Pasadena, Texas and Baltimore. 34 story office building in Baltimore purchased for executive offices.
Research: New or improved processes developed for hydrazine, sulfur recovery and refining, sodium chlorite, sodium nitrate, and new high analysis fertilizers to be produced in 1950.

MERCK & CO., INC.

Net Sales: $73.6 million.
Expansion: $6:4 million.
Facilities Expanded: 1949 completions: additional antibiotic manufacturing finishing and packaging facilities, a new miscellaneous organics building and a St. Louis Branch office and warehouse. Equipment expenditures made for initial production of cortisone and for Vitamin A and Animal Protein Factor supplement. New manufacturing and laboratory buildings completed at Valleyfield, Quebec. New plant site being sought and negotiations underway with Army for lease and ultimate purchase of a war plant.
1950 Plans: $3.3 million remaining to be spent on 1949 authorizations.
Research: $3.83 million research pilot plant addition and another laboratory building for Merck Institute of Therapeutic Research completed. Development work on cortisone, Vitamin B-12, and animal protein factor.

MONSANTO CHEMICAL CO.

Net Sales: $166 million.
Expansion: $9.8 million.
Facilities Expanded: 300 ton/day (replacement) sulfuric unit and new boiler plant installed at Everett, Mass. Fluorine scrubbing unit added at Monsanto, Tenn. Polystyrene and vinyl chloride production increased at Springfield, Mass. Texas City styrene plant replacement completed and new adhesives plant near San Francisco under construction.
Research: New organic products included N-benzoyl sulfanilamide, several anti-histaminics and tetraethylthiuram disulfide. Silica lamp bulb coating, synthetic baking resins and misc. coatings for wood, blueprint paper, plastics, metal, paper, leather and fabrics introduced. Attention given to improving phosphate salts and to food additives, synthetic detergents and ammonium phosphate. New lab at Texas City completed. New vinyl chloride resins and film introduced.

PENNSYLVANIA SALT MFG. CO.

Sales: $33.2 million.
Expansion: $4 million.
Facilities Expanded: Completions: The Calvert City, Ky., sulfuric, hydrofluoric acid and related products plant, and anhydrous ammonia cylinder filling unit at Cornwells Heights, Pa., and a steam power plant at Wyandotte. Wyandotte alkaline detergents capacity increased 10%. Portland, Ore., sodium chlorate and chlorine facilities also increased. Calvert City fluoride sales addition authorized.
1950 Plans: Postwar expansion program begun in 1947 substantially completed.
Research: 1949 budget largest in company history. Gradual expenditure increase planned. Emphasis on application research continued. A potentially important chlorinated organic and a group of inorganic and organic fluorine compounds advanced to field evaluation stage.

CHAS. PFIZER & CO.

Sales: $47.6 million.
Expansion: $4.57 million.
Facilities Expanded: Synthetic caffeine and theophylline plant completed at Groton. Terre Haute facilities expanded to produce Bi-Con APF-3, new poultry and swine feed supplement. Pilot plant production of synthetic Vitamin A begun. Added anti-biotic fermentation facilities installed.
1950 Plans: Expenditures, including commercial Vitamin A plant and continued development of the Groton plant are expected to be approximately the same.
Research: 1949 research expenditures were more than doubled and personnel correspondingly increased. New chemical engineering and process building completed in Brooklyn and equipment being installed. Chemical and biological research, pharmacology, and product evaluation facilities expanded. Terramycin, new anti-biotic, to be introduced in 1950.

PHILLIPS PETROLEUM CO.

Facilities Expanded: Capacities for anhydrous ammonia, ammonium nitrate and ammonium sulfate greatly expanded to 154,000 tons, 100,000 tons and 270,000 tons/year respectively. Sales group organized to market output. Carbon black expansion under consideration.
Research: Developments include "cold" rubber modifiers, rubber synthesis accelerators, and isohexanes for vegetable oil extraction. Catalyst and emulsion polymerization research may result in low cost plastics from relatively cheap olefins and sulfur dioxide.

PITTSBURGH COKE & CHEMICAL CO.

Sales: $22.8 million.
Expansion: $2.7 million.
Facilities Expanded: New coke oven battery expanding capacity from 70 to 105 ovens completed, increasing coal chemical supply. 2,4-D facilities expanded. Parathion plant installed. Benzene hexachloride plant nearing completion. Additional formulating and storage facilities constructed. Agricultural sales increased almost 300% over 1948. Protective coating capacity doubled. Fourth cement finish grinding mill added. Blast furnace flue dust briquetting plant completed.
Research: New research lab completed. Additional chemical specialists added to staff.

PITTSBURGH PLATE GLASS CO.

Net Sales: $281 million.
Expansion: $12.5 million.
Facilities Expanded: Chlorinated benzene and

(Turn to page 792)

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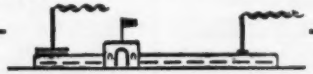

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BUSINESS OPPORTUNITY

Chemical Specialties

(Continued from page 726)

kali, petroleum products, or related corrosives.

• **Adenosine-5-phosphoric acid** is being produced by Schwarz Laboratories, Inc., 202 E. 44th St., New York, N. Y., in a purified form as Lycedan. Supplied in ampules, Lycedan is used in management of diseases of basal metabolic function such as cardiac and rheumatic conditions. Adenosine-5-phosphoric acid for pharmaceutical manufacture is now being supplied by Schwarz at reduced prices.

• **Penaire Penicillin Inhalator,** produced by Sharp & Dohme, Philadelphia, provides a method for penicillin powder inhalation. Capsules supplied with the inhalator contain 100,000 units of finely divided crystalline sodium penicillin G powder, which is stable in dry form for a prolonged period. Inhalation of penicillin powder by this means is used in treatment of certain infections of upper and lower respiratory tract, such as sinusitis, pulmonary abscess, bronchitis.

• **Rheumatoid arthritis** can be symptomatically treated with Sharp & Dohme's Sharmone Pregnenolone Acetate tablets. It is a steroid related chemically to ACTH and cortisone.

New Pigment Process

(Continued from page 681)

yield a pigment-grade titanium dioxide. Actually, the processing is very similar to that of ilmenite. The following example closely simulates the conditions and results of commercial practice:

About 6½ lbs. of slag and 13 lbs. of 93% sulfuric acid are mixed in a heated iron pan placed on a hot plate (steam is used commercially). The mixture is stirred and water is added when the temperature reaches 125-175° C. Stirring is continued while a violent reaction ensues (which may start without addition of water) and until the mass has dried up—generally in about 3 minutes. After sitting for 2 hours at 160° C the mass is cooled, chipped out of the pan, filtered and analyzed. This procedure gives a titanium recovery of at least 80%.

In commercial-size equipment, time required to digest and leach slag concentrate may be as little as half of that required for ilmenite.

Chemical Industry Expansion

(Continued from page 787)

related products plant and 25% chlorine expansion completed at Natrium, W. Va. assuming position as "nation's leading merchant chlorine producer".

Research: Intensive research on insecticides and herbicides. Some initial production of these and chlorine derivatives expected this year. Research on urea and alkyd resins for coatings. Laminating and casting characteristics of various plastics improved. New and improved brush products developed. New uses found for Hi-Sil silica pigments. Joint color research project with Psychological Lab. Johns-Hopkins. Continued participation in University of Chicago Institute of Nuclear Studies program.

ROHM AND HAAS CO.

Sales: $62.4 million.
Expansion: $2.5 million.
Facilities Expanded: Principally existing production and service facilities.
1950 Plans: $7 million program directed principally toward enlarging and improving existing facilities.
Research: Substantial portion on developing new fields. More complete line of Ion Exchange resins developed. Contract signed with Army Ordnance to organize and operate a rockets and jet propulsion fuel lab at Redstone Arsenal, Huntsville, Ala.

SCHENLEY INDUSTRIES, INC.

Expansion: Modern waste disposal plant built at Cedarhurst distillery on Patapsco River, Maryland, 16th in as many years.
Research: Technical information exchange agreement signed with Bayer pharmaceutical labs at Leverkusen and Elberfeld in Western zone whereby Schenley receives license for U. S. production of any Bayer development in the prevention, cure, and treatment of disease with Bayer receiving penicillin and streptomycin know-how. An initial result is U. S. clinical distribution by Schenley of Tibione, tuberculosis treatment drug. Research center purchased near Stamford, Connecticut. Research continues primarily on antibiotics. Research on animal protein factors resumed.

SHELL OIL CO.

Expansion: Additional acetone facilities added at Houston.
Research: Small group organized at Houston to concentrate on process and product improvement and byproduct utilization. To improve customer service in Eastern markets, major portion of technical service activities transferred from Martinez, Calif. to a new lab at Union, N. J. Expansion begun at Shell Development's Emeryville Labs to permit further research centralization there. Progress at Modesto Agricultural Lab in applying petroleum products and derivatives to agriculture. Several new agricultural products in field testing stage.

UNION CARBIDE AND CARBON CORP.

Net Sales: $586 million.
Expansion: $71.8 million. By divisions: Alloys and Metals 21.7 million; Chemicals and Plastics 41.1 million; Electrodes, Carbons and Batteries 3.5 million; Industrial Gases and Carbide 5.4 million.
Facilities Expanded: Chemicals and plastics expansions in Indiana, Texas, and West Virginia. Phenol plant construction commenced in Ohio. Plastics fabricating plant completed in Canada. Production and power facilities expanded for alloys and metals in Ohio and West Virginia. Three large-tonnage, low-purity oxygen plants were completed by the industrial gases and carbide group. Electrodes, carbons and batteries facilities increased in a number of established plants.
1950 Plans: Somewhat lower expenditures anticipated in 1950.
Research: Emphasis on synthesis of organic chemicals; improved plastic products; metallurgy and use of electric furnace products; separating and treating atmospheric and hydrocarbon gases; and increased use of carbon as an inert substance. Operating plants at Oak Ridge, Tenn. for the AEC and otherwise contributing to research in and development of atomic energy.

U. S. INDUSTRIAL CHEMICALS, INC.

(Year Ended March 31, 1949)
Net Sales: $50.8 million.
Expansion: $3.07 million.
Facilities Expanded: Largest expenditures for water-soluble products facilities in connection with Stanolind's Brownsville hydrocarbon synthesis plant. Two ocean-going tankers fireproofed. Curtis Bay shipping facilities and Chicago storage and packaging facilities expanded.
1950 Plans: $4 million expenditure planned in ensuing fiscal year including completion of the Brownsville facilities and Chicago expansions, synthetic chemicals expansion at Fairfield, improved dry ice facilities at New Orleans, research and pilot plant expansion at Baltimore and essential oil and insecticide improvements at Bayonne.
Research: All research activities consolidated in Baltimore area except Dodge and Olcott and the Newark resin technical lab. Research and pilot plant facilities erected at Fairfield. Program includes chemicals, fermentation products, insecticides, synthetic resins, and essential oils. Major activity is continuing work on the Brownsville products.

VICTOR CHEMICAL WORKS

Sales: $29.4 million.
Expansion: $2.2 million.
Facilities Expanded: A. R. Maas Co., South Gate (Los Angeles) Calif., producers of phosphoric, phosphates, and photographic chemicals acquired June 30, 1949. Other additions totaled $672,000.
Research: $524,000.

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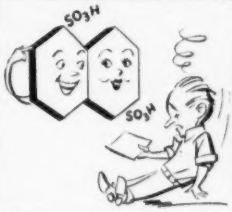
☐ Time-consuming stratification step.

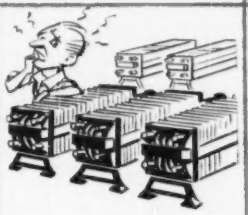
☐ Solvent losses during extractions.

☐ Batches too small.

☐ Organics resist conventional sulfonations.



☐ Wrong isomers formed.



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☐ Spent acid disposal.

☐ Corrosion from by-product HCl.

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